ANUMUKTI

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Why I Oppose Nuclear Power

Talking to scientists and engineers al Kakrapar and Tarapur, I have often had the feeling that we were either talking two different languages or were engaged in a dialogue of the mutually deaf. Inspite of my great admirations for their sincerity and enthusiasm, their efforts to convince me of the desirability of having nuclear power plants in the country have, I must confess, fallen far short of target. Their arguments have not satisfied me, for zeal alone does not persuade and sincerity alone cannot carry conviction.

First of all, I would like to see a position that ought to be common between participants of any dialogue — the position of being seekers of truth. I try to keep my mind open to the best of my ability and appreciate a reciprocal openminded response from the other side.

They talk about progress, development and advancement. Who does not commend these values? But there seem to be two entirely different concepts of these words. Top most nucleocrats have often said that the progress of a people can be measured by the quantum of electricity used by them. Can consumption of electricity really be the measure of progress? As a matter of fact, can the consumption of anything ever be the measure of development ? There is a question of values here. Where does the advancement of the individual and the society lie, in consumerism or in sharing? History is replete with cases of decline in civilisation when people have made increasing wants their ideals and goals. What I would like to emphasize is that increasing wants and progress are not synonymous. Progress of a civilisation to me is based on inner joy rather than on outer accumulation. The joy among individuals and communities depends more on mutual cooperation, willingness to share each others sorrows and happiness, fortunes and misfor-tunes, rather than on a self centered attitude with each person bent upon competing with the other in a race to accumulate wealth. Progress of a society is based on a healthy balance between change and stability resulting in a steady journey towards higher goals, rather than on ever increasing activity to counteract (real or make-believe) threats to internal security. Progress lies in good neighbourliness which creates a sound basis for mutual security and commercial and cultural exchanges rather than on increasing suspicion and lack of trust in neighbours leading to an arms race. Pro-gress lies in peace, rather than in war. Progress of mankind depends on a science of life, a science which respects, enhances and cherishes life, rather than on a science for death, a science that plans and executes destruction of human beings and environment.

Next comes the question of priorities. For whom are we making these enormous efforts? In our society the distribution of the dividends of these efforts is appalingly unjust. The immediate risks of nuclear activity are faced by the poor adivasees living in the vicinity of Kakrapar (or at other spots where the nuclear facilities are located) but the benefits of the electricity produced by them are enjoyed by a small minority of bulk consuming industrialists. To help those who have, by putting at risk those who haven't goes against the very foundations of justice. A society which cherishes egalitarian ideals, should begin its development by seeking the good of the lowliest and the lost, rather than begin at the top in the hope of benefits trickl-ing down.

The concern about pollution of the environment is often sought to be met by the argument that coal and other chemical industries create equal if not more pollution. I hold no brief for these other polluting agents. But the existance of other agents does not reduce the undesirability of radio-active pollutants, especially when we consider their millenia lasting effects.

My ecological concerns are rooted in my con-cept of man's relationship with nature. There is a concept which considers man as the conqueror of nature. I believe that this idea leads to exploitation and ultimately depletion of natural resources. I perceive man as an integral part of nature, who must endeavour to live in harmony with it. Split-ting of the atom has broken the harmony of nature. The bomb destroyed two cities and threatens to destroy the rest of mankind. The power plants have the potential to pollute the whole planet.

Science of death is secretive. 1 am concerned about the atmosphere of secrecy maintained around nuclear activities. It is strange, that in a free demo* cracy like ours, the Department of Atomic Engery, is not responaible even to the Parliament. The phenomenon *of* 'classified information' is a violation of a citizen's fundamental right to know. If we are prepared to invite experts from across the borders to visit our nuclear plants, why are some of the reports about nuclear plants concealed from our own public?

The efforts to prove that nuclear generated electricity is cheaper than other sources is far from convincing, because the social costs involved in the production are hardly ever counted, the costs of waste disposal seldom reckoned and those of decom-missioning of the plants after a short lifespan of 25 to 35 years are yet to be calculated.

I am not convinced that nuclear power is either cheap, clean or safe. Each one of these claims can and has been challenged. But more than that I am not convinced that the monsterous effort put in to produce this energy is in the right direction. The direction is totally misleading. To me it seems to be leading the poor towards starvation; the less informed towards absolute ignorance; the weak towards complete istrablity: the already not-so-clean world towards difty irremedial pollution; the vulnerable planet towards its doom.

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Bombay Peace March

About 1500 enthusiastic college boys and girls along with Sarvodaya and other peace workers took out a peace march from the Gandhi Museum (Mani) Bhavan) to Chuchgate in Bombay on August 6th. The marchehs carried placards, 20 feet long bannerss and wore peace badges, T-shirts and aprons inscribed with anti nuclear slongans. The march ended with a demostration followed by a street play outside Churchgate station. An exibition of about 100 posters on 'Nuclear Disarmament and Peace' was inaugerated at the Government Law College. An anti-nuclear book, the first of its kind in Marathi was also released on the occasion. Entitled 'Nuclear Power : Curse not Boon', it is written by Shri Gangaprasad Agarwal, a veteran Sarvodaya worker from Marathwada. The march received extensive coverage in the Bombay print media.

Bombay Sarvodaya Mandai plans to continue its programme of educating the people on nuclear issues. It recently organized a poster exhibition and a lecture at the Elphinston College. Similar activities are planned for other colleges in the coming days.

Sociology of Nuclear Disaster Reporting

The Issues raised in two articles which were published by *Media Monitor* (Nov| Dec 1986) are critically important particularly for India and oilier Third World societies where science reporting is still in its infancy. There are no specially trained journalists, nor training centres, for science report-ing. Only recently, a few newspapers have started periodic science supplements, which primarily aim at popularisation of science, as against critical re-porting on high science and nuclear activities and man-made nuclear disasters. For example, to my knowledge, no science supplement has so far carried a story on TMI, Chernobyl and Challenger dis-asters or on radiation hazards from the Chernobyl fallout

Let us recall how the Chernobyl disaster was reported in India. The explosion took place in the early hours of April 26, 1986, and it was detected over Sweden by the next morning. By the 28th ail western media were buzzing with Chernobyl news, comments and criticism, assessments and mostly guesswork as to what might have occurred inside the USSR. On the morning of the 29th first news of Chernobyl reached India over the BBC but no newspaper carried any report that morning. Bet-ween the two official media, TV (Doordarshan) placed embargo on the news while AIR managed a brief mention in its late night broadcast. Only on the morning of the 30th—full four days after the accident—our national dailies reported the dis-aster mainly quoting Reuter, PTI and A.P. TV finally reported the accident in its regular night news bulletin almost six days after, and still without any comments from any Indian or foreign scientists. On May 1, *The Statesman* carried a special report from its Paris correspondent and based on European sources indicating the severity and possible threat to population and environment posed by the accident. It also indicated that full details were still awaited to make an assessment of the distaser. But TOI, in contrast, while reporting the accident on April 30th, came but with a hurriedly written editorial, "A Major Mishap", in which a rather poor attempt was made to pre-empt criticism of nuclear power and cushion the impact of the worst disaster. Describing it merely as a "mishap", without any scientific basis, the editorial attempted to defend a basically indefensible position by claiming that "the kind of pressure that seems to have caused damage to the reactor at Chernobyl is not created in Indian reactors". Upto that time we did not even know the type of reactor system involved in the Chernobyl accident. Apparently, the inside information came from the Department of Atomic Engergy. which was troubled lest public papic should also turn against the nuclear power program-me in India.

Indian Express, in contrast, carried long reports on the 30th morning based on western news agencies but its science correspondent (Somnath Sapru) gathered technical details of the reactor and raised a pertinent question whether the radiation fallout could reach the Indian sub-continent. IE was the sole exception in this regard and it invited my critical comments. Later, I learnt that no Indian scientist was willing to make comments to the press. It was in direct contrast with the western scene where, as David Rubin has reported in MM, the media had collected techno-scientific details, in cluding probable ill effects of radiation fallout from 300 scientists of various institutions within the first few hours.

Indian media in the following days, weeks and months showed little interest in the outcome of the accident. The only exception was when *The Obser-ver* (London) team released their best-seller. *"The worst accident in the world Chernobyl: The end of the nuclear dream"*. Almost all national dailies and several weeklies published excerpts from the book and highlighted the seriousness of the accident But there was still no critical reporting, gathered from independent sources, nor was there any deeper, attempt to bring details of the disaster to Indian readers. Of course, the official media(TV)made special programmes to boost the damaged prestige of nuclear energy in this country. It was repeatedly asserted that our country's nuclear safety records were the best in the world and that there is no possibility of a Chernobyl in India. While many publications gave no credence to the official claims, TOI, and *The Hindu* remained fervently pronuciear to the extent that they opposed any weakening of the nuclear energy programme. *The Hindu* even editorially ridiculed those who opposed nuclear power on environmental grounds. IE under the editorship of George Verghese was exceptionally critical of nuclear energy and maintained a critical posture vis-a-vis nuclear technology.

From a journalist's perspective a nuclear power plant accident is not like a natural disaster—hurricane, floods or earthquakes where, as David Rubin described, "disaster information specialists" arc ready to assist him with information. But there are not many precedents of a nuclear disaster, there is no-one to brief you on the spot and there is little scope for a courageous reporter to rush to the site of nuclear accident and give an eye-witness account of the scene. All nuclear accidents immediately make the site inaccessible, if it was not already so. In order to avoid public panic, strict secrecy is maintained by the authorities, and the media are totally dependent on official sources for comments and details. A reporter's own knowledge and understanding of nuclear problems is. therefore, critically important in providing the public with a comprehensive picture of the disaster. Only journalists with such understanding and knowledge and good resources at their disposal, good contacts with official and independent scientists, can effectively report on a nuclear disaster.

Nuclear power has come up as a commercial and industrial activity not due to peaceful scientific research but as a direct outcome of war-oreinted research activities. Thus it is conducted under total secrecy and only with government funding and patronage. And since governments have vested interest in promoting nuclear programme all official efforts for the last 40 years have been directed to projecting pro-nuclear arguments. This over selling of nuclear energy has made our journalists conditioned to pro-nuclear perspectives. Nuclear power has been propagated as the ultimate in energy sources. Because it has been equated with national progress and technological advancement, without reflecting on the possible consequences for future generations, our media have shown a general consensus that does not want to upset the country's nuclear boat.

Vilanilam, while comparing NYT and TOI reporting on the Three Mile Island accident, explained one possible reason for the newspaper's benign attitude towards nuclear power as "national pride and support to one's government". Admittedly such is the case as was vividly demonstrated by the cold war rhetoric of the US media during early reporting on Chernobyl. Nuclear reporting is very much linked with foreign (and defence) policy perspectives of the media. This chauvinism has been a determining factor on nuclear accident reporting, or non-reporting, in this country.

The same reason governs the behaviour of our political parties and parliamentarians which do not insist on discussion of budgetary details of critical ministries—Atomic Energy, Spare and Defence. There are hardly any critical books written by Indian scientists and / or social scientists, economists, or even environmentalists of this country on social ramifications of nuclear energy, and space research, as these are inherently linked with the country's defence aspirations. Indian journalists are integral to our social ethos and scientific detachment from one's national bias is too tall a parameter for the Indian media.

TMI and Chernobyl accidents have raised the fundamental question of reassessment of nuclear fission technology as a reliable source of energy for the 21st century. But judging from TOI and *The Hindu* coverage of these accidents and contrasting them with reporting in *The Guardian, The Observer,* and *New Scientist* (Weekly) of England and *Indian Express, Sunday Mail, Sunday Observer,* and *Illustrated Weekly* (under the present editor ship of Pritish Nandy), it appears that the pro-or anti-nuclear stance is shaped by attitudes in respect of the Establishment in general. 'Political realism' determines the depth and direction of reporting on a nuclear crisis, even if it glosses over scientific facts. Anthony Tucker, a noted journalist and science editor of *The Guardian,* and several writers in *New Scientist* have published substantial data indicating that nuclear power after Chernobyl has become a 'phasing out' proposition. Indian publications, in this critical group, also appear to have maintained a pro-environmental position and have reported strong public concern against nuclear radiation Hazards.

Sometime, after the TMI accident in 1979, *Illustrated Weekly* carried an extremely pro-nuclear article. When I approached the *Weekly* for a critical view to be given equal space, the then editor replied that so long as he was in that chair no anti-nnclear view would be published in the *Weekly*. And then he confided, "I have to live in Bombay (the headquarters of the department of Atomic Energy)". There is another, more serious and committed, attitude which also inhibits objective reporting of nuclear accidents. *The Hindu* sincerely believes that nuclear energy offers a powerful means for our national advancement and, therefore, any adverse reporting would harm the national cause. Its proprietor-editor told the writer that he has placed his unquestioned faith in the knowledge and authority of India's nuclear scientists.

All nuclear accidents are caused by human error (technical failure has not yet been established). While in a natural disaster, no-one is humanly responsible, in case of nuclear disaster, fixing the responsibility of blame or error is critically im-portant. The journalist's task is, therefore, very sensitive, as it brings him | her in direct conflict of interest with those who are the sources of informa-tion, and in all probability themselves are the epicentre of the disaster. In India, thereforce, there has never been a public enquiry into a nuclear accident, and there has never been a case in which responsibility has been fixed for radiation leaks. The gap between the official source of information and the journalist's investigation is too wide for any relible reporting on nuclear accidents in this country.

Besides, as stated above, there are no independent scientific sources (non-government) or public interest organisations which can help the media persons. There are also few vocal, non-official scientists in our country. Many members of Parlia-ment have told this writer that government must listen to the scientists who are qualifiled and paid by the exchequor to advise on the complexities of nuclear policy. But nuclear reporting requires easy access to critical data (official briefing is not sufficient) which, in the prevailing secrecy and non-accountability of our nuclear sub-government, is not possible. A poor Indian or Third World journalist unprovided and unprotected (against the official wrath), cannot prepare an authentic story on nuclear disaster.

In reporting a nuclear accident the most crucial point is then to respect the responsibility of news-media to the public interest, particularly in a closed information system. The Chernobyl nuclear disaster is not the first, nor is it the last, but the worst atomic accident of our times. Indian news-media must be prepared for any future eventuality, especially since government has launched an ambitious programme of producing 10,000 MWe nuclear power from inherently unstable breeder reactors. It is suggested that special training programmes may be worked out for our science writers and reporters in order to update them with necessary information, critical data, and details on earlier accidents and on safety measures and man-agement of atomic crisis systems. Our media must also be familiar with civil defence administration, available to the public in India, in the event of an atomic disaster like TMI and Chernobyl.

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Courtsey : Media Monitor March/April, '87

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Irritation Over Irradiation

An *"important* milestone in food preservation methodology since the successful development of canning in the 19th century" — this is how the Department of Atomic Energy (DAE) in its PR magazine *Nuclear India* characterises the zapping of food with radiation. The process, which prolongs the shelf-life of fresh food, is called irradiation.

Irradiation seems to be the fashion worldwide. Thus, a Malaysian seminar recently announced that frozen shrimp exported to Japan would soon be treated by this "modern" process. Its pro-ponents are Malaysia's Nuclear Energy Unit, which has a vested interest in this, and Canada, one of the largest producers of Cobalt-60 in the world.

In Japan, the government has announced that irradiated oranges and fish paste products would soon be allowed into the country, in the interest of reducing trade frictions with the United States.

Increasing alarm

But there is also increasing alarm about both the safety of the process and the motives of those who" are pushing it. Mainly because of health hazards, the European Parliament has refrained from authorizing irradiation in general and has banned the import of irradiated food from countries other than the members of the European Community While the process is still under discussion in the United Kingdom, in West Germany selling of irra-diated food on the internal market has been banned For the export of food no such law exists.

In India, which recently cleared the applica-tion of radiation for preservation of onions, potatoes, frozen sea foods and spices, critical voices are raised. Kalpana Sharma writes. "The wisdom and appropriateness of the Government's decision allowing irradiation of certain food products for export and for the domestic market can he seriously questioned."

Food irradiation

The technology for irradiation has been available for more than twenty years. However, it has been applied for conserving food only recently. Beside applying accelerated electrons or X-rays, cobalt-60 or ceasuim-137 can be used in loading a device which produces beams of ionising radiation. Cobalt-60 and ceasium-137 are waste products of nuclear industry.

In relatively low doses of less than 15 kilorads the radiation prevents potatoes and onions from sprouting. Doses up to 50 kilorads delay the ripening of fruits like mangoes or bananas and extend their shelf-life by one or two weeks. It kills insects, bacteria and some fungi and thus disinfects and conserves fruits and vegetables without chang-ing their outer appearance. Higher doses around 200 kilorads "can extend the acceptability, and, in turn, marketability of iced fish by about two weeks". (*Nuclear India)* Spices may be exposed to kill insects and microbes.

It has to be noted that the dosage is not high enough to make irradiated food radioactive. However, the international debate on the health hazards of this process shows that research into this question did not yield uncontradicted conclu-sions so far.

Debate on health hazards :

The joint Expert Committee on Food Irradia-tion, which was set up by the Food and Agricul-ture Organisation, the World Health Organisation and, significantly, the International Atomic Energy Authority, declared irradiated food as safe, if it had been exposed to a dosage below 1 Mrad. This decision was made "on the basis of extensive wholesome new studies with laboratory animals carried out in different countries" claims the DAE. However, the Japanese scientist Dr. Kosei Takahashi found that the joint committee had ignored data which contradicted their findings, including Japanese and Soviet studies which showed mutations and organ changes in mice fed with irradiated diets.

In the US the Food and Drugs Administration has limited the permissible dose of radiation to a maximum which is smaller than the international!) recommended value by the factor of ten. The contradiction in what has to be regarded as a safe dose must make us suspicious of the validity of the research carried out in both cases.

The supporters of irradiation in the US rely heavily for their safety arguments on a series of 17 studies done by the Industrial Biotest Laboratories for the US Army, which "proved" irradiation to be safe. An investigation by the US General Accounting Office has since revealed deficiencies in their methods and in 1983 three executives of this institution were convicted of falsifying test data material relating to other drugs and chemicals. Such is the reliability of research carried out by institutions which are close to agencies having a vested interest in certain findings.

Research on health hazards has not been carried out on just laboratory animals. C. Bhaskaran and G. Sadasiwam from the National Institute of Nutrition in Hyderabad experimented on malnourished children which were fed with wheat which was unirradiated, freshly irradiated and wheat stored for twelve weeks after being exposed to radiation. They observed that the children fed with irradiated wheat produced abormal cells with more than the usual number of chromosomes. While this study, which was published in 1975 by the *American Journal of Clincal Nutrition*, again raises the fundamental question of the morality of experimenting with children, its validity has been questioned by some scientists because of the use of freshly irradiated wheat. Usually wheat is stored for some time after exposure to radiation. Moreover, critics of this study pointed to the nutritional status of the children used by the scientists. But is seems that the production of abnormal cells, the main result of the study, has not been rejected in general.

Another research report of the same institute warns: "It is clear that irradiation of wheat does not alter the susceptability of the grain to fungal infection but can bring about changes in the grain composition favouring an increased production of toxin." The toxins referred to are extremely poisonous and carcinogenic even in very small concentrations. In this research project only a few out of hundreds of toxin producing fungi have been studied. Besides, in practice the storing conditions are more favourable to the growth of fungi than the perfectly dry laboratory conditions in which the experiments were carried out

Spoiled food looks fresh

At doses used for irradiation, a large number of fungi and bacteria will be killed so that the food items, especially fish and sea foods, appear to be fresh. However, some extremely poisonous bacteria and viruses survive, multiply and contaminate the food There is also a good chance of mutations of these contaminants produced by the radiation which ma) create new dangerous bacteria and viruses.

Another effect of irradiation is its impact on the fruits and vegetables themselves. It destroys the cells of the products and together with that vitamins A, some Bs, C and E. In wheat 20% to 65% of Vitamin Bl is lost after irradiation and storage for eight weeks. In potatoes there is a loss of 28% to 56% of Vitamin C. In meat, radiation alters amino acids and fat.

The health hazards connected with the handling of radioactive substances like cobalt-60 nad ceasium-137 in the process of irradiation are a topic left for another article in *Anumukti* appearing later.

Consumers associations in Malaysia, Japan, Western Euripe, Australia and the US have urged governments and international organisations that the process should not be inflicted on the unsuspecting consuming public while scientists are still arguing over its effects on health. On the other hand, DAE's praises for irradiation have been quoted earlier. What is behind this attitude?

Political reasons

We find the answer to this from the DAE as well, "one of the beneficial applications of atomic energy". Beside hopes concerning the economic profitability of this technology in the future, there are other political reasons behind its development. International research on food preservation by radiation has been sponsored largely by the Pentagon and the US Department of Energy. It wan expected that this way the use of nuclear material would become a common matter of everyday life.

This would help in increasing the acceptability of peaceful as well as military uses of nuclear energy. Showing the benefits drawn from the wastes of the nuclear fuel process, the technincally as yet only insufficiently solved question of waste storage is thus expected to be settled on a political le\el.

Profits are expected from selling this technonlogy to Third World countries which find difficulties in storing and distributing fruits and fish by conventional methods. These countries, on the other hand, want to increase their exports of food products by more effective systems of conservation.

But is this process appropriate for countries like India? Its required capital and its running costs are very high. Therefore, it has been suggested to invest the money needed for its application first into the construction and development of traditional facilities like rat free silos, refrigeration and packing which are cheaper and safer.

Irradiation also means the centralisation of food processing in huge monopolistic complexes dominated by a few industrialists and beaurocrats. The control and regulation of its application itself is a complicated and expensive process posing new legal and administrative questions. Finally, irradiation contributes to a further export orientation of agriculture and food production, the wisdom of which needs to be questioned seriously.

Note : This article is based on material prepared by Ms Hafija Ibrahim from the Consumers Association of Penang, Malaysia, and distributed by Third World Network Features. Other sources are Kalpana Sharma, "Hazards of irradiation", in Indian Express 3-7-'87, and "Atomic Energy and Food Preservation", in Nuclear India. Vol. 25/2 & 3/86, Pp. 8-10.

Alarm Over Safety of Soviet Reactors

The Soviet Union's most popular type of nuclear reactor has come under fire because of their poor record on safety. The Soviet Union builds a large nunmber of pressurised water reactors known as the VVER and exports them to Eastern Europe, Finland and Cuba. A report leaked from the International Atomic Energy Agency (IAEA), which polices the safety of reactors all over the world, indicates that the VVER reactors have one of the worst records on safety.

The report was published by the German magazine *Der Spiegel* The magazine had details of 18 accidents in nuclear plants all over the world between 1981 and 1985 out of the over 250 accidents notified to the agency during the same period. The magazine says that 16 out of the 48 incidents occurred in the Russian built VVER reactors. In 1984 alone Czechoslavakia's largest plant at Bohunice, reported four incidepts to the agency.

Meanwhile another report on the VVER reactors by a nuclear scienntist Dr. Helmut Hirsch and published by the Greenpeace of Vienna is highly critical of their safety. This report looks at a serious accident at Kozloduj in Bulgaria on the 21st of February '83. This accident which was kept secret by the Bulgarian government from its own public is also noted in the IAEA report.

Following an electrical defect two valves were opened in the primary cooling system. As pressure inside the system dropped the reactor was switched off. During the incident, emergency cooling water put into the reactor vessel caused the fracturipg of one of the weld seems. According to the report the accident could have resulted in a disaster.

The first generation of VVER reactors — the 440s built in the sixties and the early seventies may be especially vulnerable. Greenpeace has singled out 10 of these because they have no protection against corrosion inside the pressure vessel. After persistant failure of the containment system, two units built in Finland were fitted U.S. built contain: merits. There are 28 VVER-440s already at work in E. Europe and 14 more under construction.

Source : New Scientist, 7 May '87.
WISE News Communique : 277-2370, 257-2347

Editor's Note

Chernobyl has made the whole world aware of the safety of Soviet built reactors. Chernobyl was a RBMK type reactor and not a VVER type reported above. An Indian team has already visited Moscow to negotiate for the supply of two VVER reactors.

Why are we still at it ?

India was the first third world country to em-bark upon a fullscale nuclear programme. In early 1940's even before the horrors perpetuated on Hiro-shima and Nagasaki made the power of the atom a tangible reality to everyone, Bhabha had envisag-ed nuclear power as the vehicle to launch a newly emergant India into the 'modern age'. Bhabha's dream was shared by Jawaharlal Nehru. Clothed in eloquent prose by him, it captured the imagi-nation of many. The country bidl goodbye to Gandhi and marched down the nuclear path.

In the last forty years much has changed. The world today is a very different sort of place from what it was then. People's expectations and aspi-rations have changed. The path marked 'develop-ment' no longer looks as rosy as it did then. The jargon too has changed from 'modern age' to "21st century'. During the same time there has been a revolutionary change in science. Splitting of the atom no longer seems the Mt. Everest of scientific achievement as it did then.

In this changed context, when the whole concept of 'development' is being challenged by many, it might be worthwhile to reexamine the nuclear energy programme. However, it would be futile to engage in this exercise without first understanding the historical and politico-economic framework within which the nuclear enterprise was undertaken.

It was decades of exploitation of the agricultu-ral, mineral and forest wealth of this country that had been the driving force which had sustained the industrial revolution in England. This exploitation had conditioned the thinking of many who were soon to become leaders in independent India. They were determined to prevent exploitation by forigners and for this the country had to become 'strong' and take its 'rightful place' in the comity of nations. However, to become strong, the only way known to them — the prevalent development paradigm — (Gandhi then as now was good only for lip service) was the very same exploitation and industrialisation. Hence the great stress laid on self reliance and on the core sector of basic heavy industry and the great effort spent in trying to acquire mastery of various modern technologies. In the nuclear field this meant gaining control over all the phases of the entire fuel cycle. The objective was to develop indegenous capability to locate minerals useful for nuclear power and to exploit them in a planner in confirmity with the national interest.

What was true of materials was even more true of knowhow. Modern science was the base for Western technological advancement and the consequent Western domination. Therefore, mastery over technical sophistication was considered essen-tial if we were not to be subjected to manipulation by the 'big brothers'. As Nehru said, "The future belongs to those who make friends with science'[5]. Another facet of this reluctance to be pushed around was to acquire the capability of building a nuclear arsenal if desired — "Keeping the nuclear option open".

There were other secondary factors too in our decision to trudge the nuclear path. Cheap reliable and abundant electricity was seen as a vital element for development. Nuclear power was perceived as one of the awnsers to meet this massive expected electricity demand. There was also the expectation of 'spin off effects.(e.g. food irradiation technology, advances in metallurgy of rare earths etc.) The thinking went that if we could 'deliver the goods' in such a complex enterprise, it would increase confidence in indegenous capability and allow us to do less sophisticated tasks with ease.

A climate of distrust and mutual suspicion between us and the nuclear 'haves' has prevailed during the post independence era. The policies persued by all the nuclear haves throughout this time have only served to reinforce this distrust These policies have swung from total denial of access to nuclear technology in the supersecret early days, to the commercial hustle of the 'Atoms for

Peace' **era** and back to denial as signified by the Nuclear Nonproliferation Treaty (NPT) and the 'Club of London'. Nuclear suppliers have abrogated existing commercial contracts with impunity, (e.g. U. S. enriched uranium for Tarapur) Their behaviour can be characterised as trying to impose a new set of rules midway during the game.

With this perspective let us see where does the Indian nuclear programme stand in todays world context. The primary original objectives of self reliance have already been met and have become non-issues. The country has control over nuclear raw material and an indegenous capability is now present able to deal with them. Similarly a large scientific and technical base is already in existance some of it quite capable of carrying out 'frontline' research. So much so, that the country's continuing poverty and backwardness can no longer be explained away by reference to its scientific unsophistication. Today, when a graduate student can make a plausible bomb design as part of a self study project, becomming a nuclear weapons state too, is no longer a technical but rather a political problem.

Thus todays nuclear objectives are far removed from those which motivated us four decades ago. Today nuclear power is just another way of boiling water to run the turbines. After twenty years of doing just this, nuclear technology can no longer claim indulgance due to a new technology Failures can no longer be airily dismissed as 'teething troubles'. However it is precisely in the field of electricity generation that the nuclear Napoleon has met its Waterloo. Bhabha in 1962 had projected a figure of 20000 M\V to 50000 M\V for 1987 nuclear electricity production. Well, it is 1987 now and we fall short of producing even a 1000 MW. Which other industrey can get away with such unrealistically massive overprujection and such an abysmally poor performance? Now a days the DAE is all set on the figure of 10000 MW by the dawn of the 21st century. Each passing day pushes this pie a little further in the sky. In despair the high priests of the nuclear order have performed an astonishing summersault. They have given the go bye to self reliance and the country is again out, begging bowl in hand, asking our good 'friends' the Russians for VVER plants. These VVER type reactors have an appaling safety record (see news item) and besides they use entriched uranium as fuel. As yet, India has no fuel enrichment facility. We would thus be supplicants of enriched uranium suppliers for the lifetime of the plants. We seem all set for a reenactment of the Tarapur drama of the seventies, when the U. S. kept us on a tight 'leash' by releasing small driblets of fuel every few months in an effort to force us to sign the Nuclear Nonproliferation Treaty.

India's nuclear programme has thus come full circle. We started with the objective of being independent, masters of ourselves, free of domination and manipulation by forigners. It is strange to see us willing to fritter away these hard won gains today just to achieve a target. Of course, all this is one of a piece with the rest .of the '21st century' thinking.

The current of science in the last forty years too has been somewhat unkind to the nuclear enterprise which has been consigned to the back-waters. Giant nuclear plants, with all their attendent risks, inflexibilities, capital intensites, vulnerabilites, environmental hazards and other ills are beginning to look like dinosaurs at the dawn of the age of mammals. Todays 'breakthrough' areas from high temperature superconductors to genetic enginnering, from high speed computation to designer drugs all involve manipulation at the molecular level requiring very little energy.

The time is thus ripe even within the Nehruvian developmental framework to ponder over the title question. Why are we still at it? Isn't it time we placed the national interest above the vested interst of the nuclear mandarins and their political masters?

Acknowledgements; This paper has borrowed extensively from a paper by J. A. Sabato and Jairam Ramesh which appeared in the March 1980 issue of Bulletin of Atomic Scientists.

S. N. Gadekar

LETTERBOX

In this column we present excerpts from some of the letters we received in the last two months. We are very grateful for any comments, quries and criticisms. All suggestions are carefully discussed and we want to encourage our readers to write to us so that Anumukti really becomes a forund for a wide network of anti-nuclear activists.

Long live Anumukti What a good idea!

L. C. Jain.
Milap Vatica
19 C|UA Jawahar Nagar,
Delhi 110007.

Reads well and easily and the statement of objectives is clear and concise. It fills a much felt need for information on an issue about which open debate has been prevented by a modern fatalism.

Kishore Saint. The
Ashoka Foundation, ll-A,
Fatehpura, Udaipur 313
001.

It had only 20 pages .... Quite disappointing. Hope it will pick up. An appeal for funds may be made in the 2nd issue.

S. K. De
Friends Rural Centre Rasulia,
Hoshangabad-461 001.

Congratulations on the attractive *Anumukti*. I do have very many queries and comments.... The quality of printing is excellent, so the errors are 'original', i.e., in the MSS ....

Whenever you have free space left, you can provide concise information regarding nuclear plants in existance in the country, in neighbouring countries, elsewhere; planned plants; information about individual accidents and their consequences; list of interesting readings in the subject or related readings (e.g., the last issue of *National Geographic* which has an article on Chernobyl; Richard Jeffe-ries' novel from the end of he 19th century. *After London,* Oxford Classics which provides a powerful pre-view of a world ruined by man's 'progress'; of Huxley's *Ape and Essence* (1948), a horrifying dystopian prophecy, written right after World War II, projecting forward to a world after World War III; etc.)

Sudhakar Marathe Dept of
English University of
Hyderabad Golden
Threshhold Hyderabad.

It is encouraging to see such a journal in India, where there has been such a surprising lack of debate and controversy about nuclear power and (even rather little attention to nuclear explosives.)

Jim Forest
International Fellowship of
Reconciliation,
38 Spoorstraat, 1815 BK
Alkamar, Holland

Regarding the *Anumukti* format It is good that at last a linkage has been established among Indian anti-nuke activists. But I feel that the magazine's format has to be changed. Long articles like the one written by me should not be published. At best, a short half page condensation should have been sufficient with a note at the end to contact the author for a detailed article. Contact addresses of all should be given without fail. The purpose of the magazine is to strenghen the link ....
I feel there should be a separate editor for every issue and he should write an editorial. It could be cyclic.

Nagesh Hegde CANE,
138, 5th Cross, 1st
Phase J. P. Nagar,
Bangalore 560 078.

How one wishes that nuclear energy was never discovered! But persuit of science is relentless and it is basically amoral. Once man discovered fire, it was up to him or her to use it for cooking or heating or for burning down the whole of a Khandava Vana as was done under the supervision of Arjun and Krishna of the Geeta fame! Now with the discovery of atomic energy, we might have come a long way but the basic dilemma of science persists. Unfortunately for us, all sources of energy, fire, wind, coal, oil, steam and electricity have political implications. History is replete with instances to prove a general statement that those communities and countries which were negligent in mastering energy were either wiped out or had to become subservient to those who had learnt to master it. India's history is in no way different. We lost to the British not because we lacked in bravery, but because we had not the fire-power the British troops had nor the organisational and techni-cal discipline that the Western scientific knowledge had generated in those days.

As the strategic implications of having and not having nuclear power at our disposal are too ob-vious, I need not dwell on them at length, If and only if. China, Russia, Pakistan and India sign a nuclear free zone agreement, would T be willing to insist together with you on our government to stop developing nuclear weaponary. But for any suggestion of this kind from India to be taken serious note of, India will have to develop its own nuclear capability. Moreover would it not be just criminal on the part of any government to order its army to march against an enemy who can destroy not their lines of supply alone but their supply basis within a few seconds? Personally speaking 1 would prefer India prepared to get destroyed together with the enemy to India living in slavery for another thousand years.

Your objection is, if I have guessed correctly, basic, that is you are against the splitting of the atom. I think it is too late in the day to lake that position. It is like trying to unscramble an egg. I live in the hope that scientists will find some way to separate nuclear energy from its attendent destructive elements; that they will know how to control the BRAMHASTRA, they have involked.

Today you and your friends are striving for a "non-nuclear" India. Tomorrow there,might dawn the age of the super conductor, heralding a new epoch of technology with its own package of side effects. USA, USSR and Japan have alred y
reached the threshold. It will again have tremendous political implications. Should we then insist on a non-super conductor India? Science, especially modern science, will not allow any country to put the sign of "no entry" on its portals.

However, let me congratulate you on your bold effort to demystify the nuclear issue. That will show the pitfalls and prevent the government from taking the whole nation for a ride.

N. G. Goray
5511, Aylesboro Avenue
Pittsburgh, PA 15217
USA.

GLOWING ON THE JOB

Records obtained by the Public Citizen from the United States Nuclear Regulatory Commission (NRC) reveal that over 93000 workers at 83 nuclear plants were exposed to measurable amount of radiation in 1985. (The most recent year for which NRC has compiled data). A report from the Public Citizen's Critical Mass Energy Project finds a dramatic increase in the number of exposed workers as plants age. For example, the oldest plants—those which began operating in the 1960's — exposed their workers to four times as much radiation as the newest plants.

Other findings include

* Worker exposure levels have continued to worsen : the figures represent a fourfold increase over the number of workers exposed in 1975 while the number of operating reactors increased by a factor of two.

During the same time, the average of nuclear workers exposed to radiation at each reactor nearly doubled : from 579 workers per reactor in 1975 to 1132 workers per reactor in 1985.

* Temporary workers run the highest risk : while they represent one half of the nuclear workforce, in 1984 they received about two thirds of the total radiation exposure. Temporary workers can receive their maximum allowable dose at one nuclear power plant and then be employed at another plant thus receiving two or three times the allowed amount. The number of temporary workers has doubled in the last eight years.

* The problem of worker exposure to radiation is most acute at the 28 Boiling Water Reactors (BWR) in the US. On average workers at BWR's received 30% more radiation than those at other reactors. One BWR, the Susquehanna reactor in Pennsylvania, exposed 3669 people to radiation, more than three times the national average.

* Thirty reactors exposed their workers to levels of radiation higher than the NRC's "allowable" level for the general public. Three reactors — the two at Peach Bottom in Pennsylvania and the Mill-stone-2 reactor in Connecticut — each exposed their employees to three times as much radiation as the a\erage plant did in 1985.

Rather than take measures to reduce this hazard, the NRC is considering rule changes that would actually increase exposure levels. For example, it is proposing to increase the amount of radiation allowed for each worker, even though the limits are alredy 10 times higher than government recom-mendations and 680 times higher than the standards set by the Environmental Protection Agency for the general public.

Source : WISE News Communique : 275,2350

Editor's Note : Susquehanna BWR figures, (the worst US case), are old hat for Workers at Tarapur. The Tarapur plant has been regularly exposing between 3000 to 4000 workers year after year to radiation dosages from twice to thrice the average dosage to radiation workers at US plants.

Protest in Gujarat

It was raining as 6th August dawned. But that is usual; this part of south Gurajat gets a great deal of rains (75"/year) most of it during the monsoons.

Last year a rally was held at Bedkuadoor, about 3 Km from the site of the up coming nuclear plant at Kakrapar. This rally organised by Anu Urja Jagriti and Sampoorna Kranti Vidyalaya Vedchhi was to commemorate the Hiroshima vic-tims and to protest against the building of nuclear reactor in their midst. The police had resorted to lathi charge, tear gas and firing in an effort to crush people's opposition.

With memories of last year still fresh in mind, most activists were reluctant to organise another confrontation this year. Throughout last year many attempts had been made to increase mass contact with the local villagers so that a disciplined nonviolent force could be raised. But most activists still felt unsure about the discipline and peaceful-ness of the people at large. Consequently it was decided to hold a large number of prayer meetings in different villages around the plant. It was felt that this decentralised form of protest would help in maintainance of peace and at the same time allow larger numbers to participate in the protest.

The police had other ideas. Their 'bandobust' was on a scale larger than last year's. A comple-ment of 8 trucksfull of police; some brought from as far away as Bhavnagar and Valsad, with 6 horses and the usual number of officers descended on Kakrapar. They promulgated sec. 144 in the area and stopped all vehicular traffic. All this show of force was assembled, not at the site of the plant, but at the side of last year's rally.

The authorities at the nuclear plant contributed their bit by conducting a survey of a 10 Km radius area in July. This was presumably done as part of an exercise in emergency preparedness. But as is the usual practice, people were not taken into confidence regarding the purpose of the exercise, the authorities fearing that information shall lead to panic. Rumours of all kinds were thus rife and people were tense.

It was in this state of tension that 6th August dawned, raining as usual. People in villages near Kakrapar who had been contacted by the activists went about their daily tasks undeterred by the massive police contingent in their midst. They held prayer meetings, passed a resolution demanding closure of the nuclear reactor and sent letters to the same effect to the prime minister and the chief minister of Gujarat. But for the people from the far off villages, whom the activists had not contacted, the police conglomeration itself acted as a magnet. They felt that the police would not have gathered in such numbers unless a demonstration was hnmi-nant. About four thousand people walked 15 to 20 Kms in the night and gathered near the spot where the police were encamped.

The prescence of the police acted as a provocation. They were encamped near a cycle shop. Last year too they had campad near the same place. The villagers considered the shop keeper to be a betrayer. Some of them picked up some cycle tyres from the shop and set fire to them. This was enough excuse for the police to launch tear gas shells. The crowd resorted to stone throwing. The police replied with bullets.

There were 16 arrests. Those arrested were kept in the Vyara police lock-up for four days, as presumably investigations continued. They were initially charged under the newly enacted terrorist act but the magistrate refused to entertain these charges due to lack of evidence.

The news released by the Surat rural police for the newspapers and the radio tried to involve Narayan Desai with the stone throwing incident. There were also rumours to the effect that the police made efforts to implicate Narayan Desai with the violance and to arrest him as a terrorist but the idea was later dropped.

Surendra Gadekar

Nuclear News From Karnataka

The Karnataka government is finally making arrangements to send study teams to various nuclear installations in the country, in order to fulfill its long standing promise to convince its people about the feasability and the safety of nuclear technology. Four teams of five members each will visit Tarapur, Jaduguda mines, Kota, and Kalpakkam by mid October. People selected for this tour are from the North Kannara district in which the Kaiga nuclear plant is proposed to be set up.

The chief minister had proposed such a study tour two years ago, after a public demonstration against the Kaiga project. However the Hegde government had not taken any steps towards fulfil-ling its promise till the question was raised during a crowded press conference where the chief minister had to renew his promise.

All the 20 members of the study teams have been contacted by the government. Each team con-sists of one MLA, one learned person (like princi-pal of a local college), a journalist and two other local people. The leading anti-nuke group CANE (Citizens Against Nuclear Energy) is preparing background materials for the teams.

Protests Galore

Karnataka is the only state in India which harbours all the different segments of the nuclear 'fuel cycle', from uranium mining in Arebail in a fuel processing and uranium enrichment plant under construction at Ratnahalli, from the con-struction of a nuclear reactor at Kaiga to the investigation into feasability of a high level waste depository at the Kolar gold field; Karnataka has them all. Thanks, are probably due to an excess of local feeling in Dr. Raja Ramanna and Dr. M. R. Srinivasan both of whom hail from Bangalore. This uncalled for intrusion into their lives has caused resentment in many and has resulted in the springing up of many groups ready to protest the activities of the nuclear empire.

The Rare Earths Materials Plant (REMP) at Ratnahalli near Mysore city needs to be watched by every anti-nuclear group in the country. Six years ago the Indian Rare Earths began its secret activities here by building a 20' high wall on the shore of the Kannambadi reservoir along the river Kaveri. Huge pipelines and massive electricity cables were laid without any questions being asked. Local newspapers began sporadic reporting last year about the possibility of a uranium enrichment facility coming up at this complex. But for Tarapur, all Indian reactors operate on natural uranium. Tarapur is in any case destined for closure by 1992. Enrichment would hence be a step essentially in the direction of nuclear weapons production. The enrichment process requires huge amounts of energy. Thus, the facility would besides posing a grave threat to the people and the environment would be a drain of hugh energy reserve and it would be interna-tionally controversial. The DAE has, however, casually brushed aside the bomb production rumour without giving any other plausible explanation for the sudden spurt of secret activity at Ratnahally. People of Mysore — the mayor, university profes-sors, PUCL activists and students have seriously questioned these secret operations. However, till now no question has been raised in the state as-sembly. So much for the democratic set up.

Young people, especially students are taking up the REMP and Kaiga issues very seriously. Wall writtings have appeared in major cities like Bid ar, Gulbarga, Raichur, Chitradurga, Mysore and Bangalore. A rally was organized in Chitra-durga on July 17th in which about 600 people participated. A state level seminar was held in Bangalore on August 2nd. Four days later a rally was held in Bidar. Chitradurga witnessed a bandh on 14th of August during which 400 students submitted a memorandum to the district commisioner demanding a halt to all atomic activities in Karnataka. The students under the common banner of 'Progressive Youth Centre' then went to

Mysore and mobilized a large number of students there with the help of slide shows, street plays and video films. There has thus been a mobilization of a large number of people in and around Ratnahally.

Professor Vistimised

Meanwhile, Professor Ramalingam of the department of Botany at the university of Mysore has been transfered to the Karnataka university at Dharwar. He had been the most vocal among the academicians on the question of the location of the REMP complex. Undeterred by this 'punish-ment' he has continued to address other student rallies.

"Stop Kaiga Memorandum"

The signature campaign launched by CANE appealing the Prime minister of India to stop the Kaiga reactor, is gaining momentum. Many prominent writers, poets, artists and senior citizens have signed the statement. It may be recalled here that some 135 environmentalists from 32 countries who had attended the 'Global Develop-ment and Environment' conference at Penang in April, had signed a similar memorandum. Besides, some 75000 local residents of the North Kannara district have already signed the memorandum.

Nagesh Hegde CANE

Shri Nagesh Hegde is a journalist and a social activist Contact Address : C|o. CANE, 138, 5th Cross, 1st phase J P Nagar, Bangalore 560078

KAIGA MEMORANDUM

TO **The Prime Minister of India**

We oppose the Government's decision to site a nuclear power plant at Kaiga in the heart of a precious patch of rainforest. The small hit of this unique biosphere remaining should not he exposed to the hazards of radiation and other developmental projects.

- Nuclear wastes and dead nuclear plants in this river belt exposes future generations to radiation hazards by contaminating the land, water and air.
- Concentration of large dams, a naval base and the nuclear plant turns this area into a high security risk.
- Scientific energy management and tapping of safe and renewable alternative sources will meet all our energy needs.

ON BEHALF OF THE COMING GENERATIONS WE OPPOSE NUCLEAR POWER PLANT AT KAIGA.

Name Designation & Address Signature

Please Send this signed memorandum to : Citizens Against Nuclear Energy (CANE). 138, 5th Cross, 1st Phase, J P Nagar, Bangalore-560 078.

CAN 136 *INTREPID SOULS KEEP THE NUCLEAR WOLF AT BAY?*

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Editor ANUMUKTl Sampoorna
Kranti Vidyalaya Vedchhi, Dist.
Surat-394 641

Any donations over and above the subscription amount will strengthen our joint effort towards a non-nuclear India and would be greatly appreciated.

Notice Board

Antnukti needs to become an effective medium through which anti-nuclear activists can communi-cate with each other. As part of this effort we are starting this section, giving information of forth-coming events, appeals for help,-etc.

Please send us names and addresses of any contact person at Tarapur, Jaduguda, Rawat-bhata and Kalpakkam who could supply us with relevent and correct information during our visit. We shall be visiting these places in mid | late October.

Nagesh Hegde CANE

BARCOA (BARC Officer's Association) is arranging a panel discussion on "Issues in Nuclear Technology" within the BARC campus, Anushakti Nagar, Bombay on the 10th of October '87. The panelists shall include Dr. P. K. Iyengar, Mr. S. L. Kati. Dr. A. K. De, Mr. Prafula Bidwai. Mr. Dhirendra Sharma, and Mr. Ivan Fera among others. Anumukti welcomes this initiative of BARCOA.

Contact Person : Dr. Gautam Chattopadhyayu
1, 2-346-s Modular Labs BARC, Trombay, Bombay-400 085.

A 3 day workshop of antinuclear activists and students is scheduled for November '87 in Delhi.

Contact Person : Tripta Batra
C|o. Prafula Bidwai, Times of India, 7, Bahadur Shah Zafar Marg
New Delhi 110 002.

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An International Meeting of Concerned Scientists and Citizens for 'Nuclear Free World-Order' will be held in India during 8-15. January, 1988. Participants will include parliamentarians, public policy analysts, social scientists, nuclear scientists, anti-nuclear activists, and mediamen from many continents. The deliberations will be divided in 3 Sections:

A. *PUBLIC POLICY ISSUES*
B. TECHNOLOGICAL PROBLEMS
C. *DEFENCE & INTERNATIONAL SYSTEMS OBJECTIVE :* International Meeting aims to provide a critical assement of nuclear systems and suggest paramfetres of nuclear free world strategy.

LANGUAGE : English and Hindi will be the medium of the conference.

PROGRAMME : The programme will be fin-alised by the end of October. Tentatively the organisers plan to hold conferences at two major cities in India :

NEW DELHI : January 8-10,

BANGALORE : January 1214,

COST : The organiser (COSNUP) will arrange and pay local expenses — conference facili-ties, accomodation (in-family residence), and meals of participant. Due to banking res-trictions travel costs will have to be arranged by each participant. A small registration fee will be charged at the time of the Meeting. Those who would like to stay in hotels|guest houses can be assisted in finding suitable accomodations.

THE COMMITTEE FOR SANE NUCLEAR POLICY (COSNUP)
M-120, Greater Kailash, New Delhi-110 048,

ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Vol. 1 No 3 December 1987

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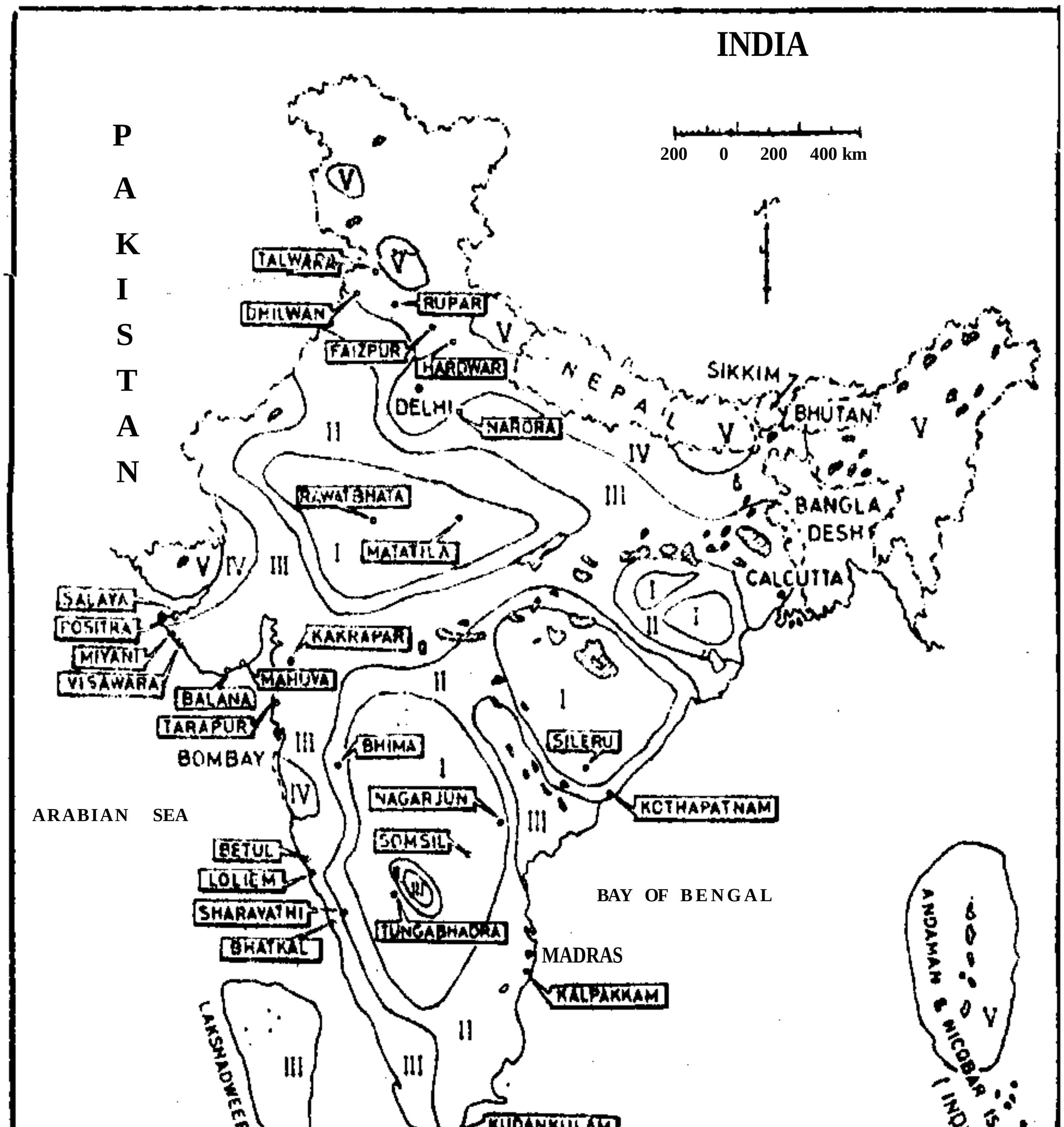

SITES INVESTIGATED FOR NUCLEAR POWER PLANTS
Seismic Zones I, II, III, IV & V correspond to V & less, VI, VII, VIII & IX on the modified Mercalli intensity sale
Shaded areas depict coal deposits

In September 1970, Government of India constituted a national committee under the Chairmanship of Shri V.R. Vengurlekar to study in depth and recommend a panel of suitable sites for setting up nuclear power stations. The modus operandi adopted by the committee was to have site investigations carried out by agencies of the different states concerned On the basis of all the accumulated data the committee made comparative evaluations of various sites.

The recommendations of the committee have never been made available to the public, despite repeated requests.. However, the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency jointly organised a symposium on 'Siting of Nuclear Facilities' in Vienna from 9-13 December 1974. In it a member of the National Site Selection Committee Shri L. Venkatesh and T.P. Sarma of the Health Physics Division of BARG presented a paper entitled 'Siting of Nuclear Power Stations in India.' This paper contains the map published on page it as well as a set of guidelines which were used by the committee to determine the relative merits of different sites. The symposium proceedings were published in a book form by the IAEA in April 1975 I strongly recommend this paper as also another by S. Krishnamurthy and S.D. Soman on siting considerations for fuel reprocessing plants (details in the next issue of *Anumukti),* to all antinuclear activists in the country. Unfortunately access to this paper is not easy. Therefore in the following I shall highlight some of the points discussed in the paper.

Site Selection Criteria

Site Selection depends to some extent on the proposed type of reactor. The Indian programme is based primarily on the natural uranium fueled, heavy water moderated CANDU type of reactors. All sites were evaluated on the basis of their suitability for setting up CANDU reactors of 1000 MW (c) capacity in stages. (Thus, existing reactor sites, e. g. Tarapur, Rawatbhata, Kalpakkam are likely to have additional units constructed on them.)

Distance from coal deposits

Even after recourse to creative bookkeeping it makes no economic sense to locate, nuclear power plants in regions with large coal fields. The breakeven distance from coal fields beyond which nucler power is expected to be cheaper depends on nuther of factors like pithead prices and the trasport costs of coal, the difference In capital costs in the construction of nuclear and coal powered units the unit size adopted for nuclear units, etc. Estimates of this breakeven distance range from 500 Km. to 800 Km from pithead.

Water requirements

Nuclear power plants are thirsty monsters. They require enormous quantities of water for both process cooling and condensor cooling. The amounts required for a 1000 MW (e) station are 300 cusecs of freshwater for process cooling and 2500 cusecs for condensor cooling. Thus nuclear power stations can only exist near large (1200-1500 acres) reservoirs or canals or on the sea coast with some additional freshwater availability. Even with these huge amounts the temperature of the outgoing condensor water gets raised by 8 degrees centigrade. This outfall water when let into a reservoir forms warm water zones which deplete the dissolved oxygen in the water and consequently provs fatal to fishes.

Condensor water is also used for disposal of liquid radioactive wastes during normal operation at coastal stations. In other words, the sea is used as a dump not only for the heat but also for the radioactivity. At inland sites where water is needed for irrigation and other community uses, this philosophy of dilution and dispersal comes a cropper. Inland sites thus need large cooling towers and storage ponds for chemical treatment and subsequent controlled release to the environment.

Electrical system

Nuclear plants are extremely capital intensive with comparatively low fuel costs and hence it is best to utilize them to the maximum extent, possible. (In technical jargon—for base load with high load factor.) It is necessary that a good part of the power produced should be absorbed quickly after start-up to avoid problems of poisoning the reactor. This can be achieved satisfactorily only if there are large industrial loads in the grid in the vicinity of the plant which can come on line swiftly.

For the satisfactory operation of the plant an assured supply of adequate start-up power of appropriate voltage from the grid is essential. The capacity of the nuclear plant should not be larger than 15% of the total capacity of all the generating units in the grid. Weaknesses in the grid can cause frequent tripping. The choice of the site of India's first CANDU reactor at Rawatbhata in Rajasthan was subsequently strongly criticised by a review committee appointed by the DAE itself (Prasad committee). The poor performance of the reactor was blamed ou weaknesses in the grid.

Foundation conditions

The geologic stability, the seismic susccptability and the tectonic features of the area are extremely important from the viewpoint of nuclear plant safety. The nature and the magnitude of any possible future earthquake needs to be accurately estimated from geophysical field experiments. This information helps in determining appropriate design parameters for the station structures, equipment and safety systems. Unfortunately, the science of earthquake prediction is still in its infancy the world over. Even in an extensively studied region like California, last month's (1. 10. '87.) Los Angeles earthquake was on a previously unknown fault. In India, as it is, the available local seismic history is rather short. As recently as December 1967, the peninsular shield of India was considered one of the stablest regions of earth free from all seismic activity. The Koyna earthquake put paid to all such comforting theories. Today, some experts believe that human intervention in the environment, e. g. in the form of large dams, can by itself be the cause of alterations in the geologic stability. Therefore, the zones should be taken only as indicators of previous seismic history and not be considered too seriously as determinants of future earthquake activity. In the aftermath of the Koyna earthquake, changes were instituted in the design of CANDU reactors as it was found that the design adopted for Rawatbhata and Kalpakkam was inadequate to withstand moderate intensity tremours. God help us if as a result of the Narmada project there are changes in the stability of Madhyapradcsh—Rajasthan region.

Environmental conditions

In the normal course of operations, nuclear plants pollute the environment through controlled releases of radioactive nuclides in the form of gases. The acceptability of such releases at a given site depends upon the disposal capacity of the environment, the concentration and transport processes of radioactive products in the neighbourhood of the site, utilization of the environment and radiation safety standards. Under accident conditions, plant behaviour is not under control and large releases of radioactivity to the atmosphere may take place. It is because of this fear of disasterous accidents that plants are situated in areas of low population density. Population distribution near the site, meteorological conditions, ground water 'flows, local environmental utilization arc all needed for site evaluation. At present, no residential population is permitted within 1.6 km of the plant and up to 4.8 k.m is only thinly populated. Administrative measures are used to restrict the growth of communities around the plant. Care needs to be taken to see that the predominant wind directions arc not towards any major population center. In fact because of the frequent storms, hurricanes, heavy littoral drift, etc. most of the cast coast of India has not been found suitable for reactor siting.

Access

Nuclear plant sites need to have good all weather roads connecting them to equipment manufacturing places as also ports of entry. The largest single piece involved for a 235 MW (e) unit is about 7.5 metres long and has a 7m diameter and weighs about 75 tons. For a 500 MW unit a single piece may weigh anything up to 280 tons. Movement of such heavy equipment to the site by tractor-trailer combination over long distances present many problems. Great length of roads concerned need to be surveyed and improvements made in bridges and culverts as well as changes made in road alignments and curves. All this takes a great deal of time.

Conclusions

The moral of the story for the antinuclear activist :

Ideal nuclear sites arc hard to find. There are many exacting preconditions, some of them mutually contradictory (low population density and close proximity to large industrial centers) which need to be fulfilled by an adequate site. In its eagerness to promote nuclear power, the nuclear establishment has made choices like Rawatbhata which later experience has taught it to rue.

Any serious attempt to achieve the projected target of 10000 MW by the year 2000 AD would mean the prompt (next 2-3 years) acquisition of many of the sites shown in the map.

A strong antinuclear movement specially concentrated around the sites in the form of well organised local groups can still prevent large scale nuclearisation of India. It is not yet too late.

Besides the points discussed above, Indian reactor sites pose a special hazard. The whole programme is based on the reprocessing of spent fuel to extract plutonium. Transport of highly radioactive spent fuel between reactors and reprocessing plants is hazardous. Considering the road and traffic conditions at present in the country DAE proposes to build small reprocessing plants right next to the reactors. Unfortunately this remedy is worse than the disease it seeks to cure. Reprocessing plants arc a bigger menace to the surrounding environment than even reactors. The concensus of opinion the world over has been either to dispense with reprocessing alltogether or to build large central reprocessing facilities and take the transport risks. In the next issue of *Anumukti I* shall discuss siting criteria for reprocessing plants.

Suraidra Gadekar.

LETTER BOX

Each era has had to face some challenge to the continuation of civilisation. However, mankind has managed to turn back from the precipice in time to save itself. I hope we still retain enough sanity to be able to solve the issues concerned with use of nuclear energy. The other side of the coin is that every new invention has brought in its wake a group of people who have felt that the new invention may lead to doom. May be, their constant vigilance and warning is what has lead to 'taming' of the new invention enough to control its capacity for doom. However, if we have as a race met all these past challenges, why should we doubt that we can and will do so once again ? No doubt, there must exist and thrive a band of vigilantes who take up such issues and work as the voice of conscience and sanity. Secondly, I feel that in the context of the world situation as it exists today, your voice of reason and sanity is too weak to be heard or to have an impact.

Sharad Shirodkar
Bombay

It was interesting to hear about the work against nuclear industry in India—I keep wondering how one can oppose both nuclear weapons and nuclear power in a non-adversarial way. I have found in the U.S. that we arc a ' 'nation of protest movements"—not a nation of peace movements. I have recently written a book called "WAYS OUT, a book of changes for peace'. 1 find Gandhi's constructive protest a wonderful resource. 1 do not believe we can ask people to give up jobs in nuclear industry without carrying them a gift of some alternative possibilities for work.

Gene Hoffman
Santa Barbara, California

This is in response to the letter written by Shri N.G.Goray (Vol. 1 No. *2*, October, 87). He seems to live under an illusion that scientists will find some way (one day) to separate nuclear energy from its attendent destructive elements and further that they will know how to control the BRAMHASTRA they have invoked. Any dillemma of science is also the dilemma of our entire civilisation. But for him the problem of nuclear energy seems to be the persisting diemma of science alone. If one knits his emphasis on mastering energy (underlining the national and intcrnattional politial implications to enforce hierarchy) and the question of signing of a nuclear free zone agreement amongst China, Russia, Pakistan and India (a most improbable event) one finds that his vision is that of a nuclearised India living under a conceptual deception known as the 'doctrine of deterrence'. We should instead strive for a non-nuclear India and a nuclear free world in the interest of preserving both ours and the global civilisation.

R.Mani Vannan
Delhi

Save The Western Ghats-March

About an year ago, environmentalists working in different voluntary organizations in South India-Kerala, Tamil Nadu, Karnataka, Goa and Maharashtra, met in Goa to discuss the environmental problems of this region and share their experiences.

These discussions brought out the important role played by western Ghats in India's environment, cultural life and economic development. The Western Ghats which rise in the hills of Southern Tamil Nadu stretch out into a range in Kerala, Karnataka, Goa and Maharashtra. All the eastwards flowing rivers of South India originate in the Western Ghats. The high rainfall region of these Ghats contain an invaluable wealth of flora and fauna. They provide the raw material for an innumerable number of artisans in the region. They contain the most varied kind of Horticultural gardens of Rubber, Coffee, Pepper, Cardamom, Areca and Coconuts, In short the Westernghats are a backbone for the economic well being of the entire southern part of India.

However, in the last few decades, the Western Ghats have been exploited beyond reasonable limits under the pretext of 'development'. The hydroelectric projects built to support a chain of heavy industries have destroyed lakhs of hectares of pristine forests. Vast tracts have been felled to provide raw materials to industries. Mining activities too have had their toll. These areas continue to be barren even after all mining activity has ceased. Valuable trees have been felled to meet the needs of the rich urban dwellers and for export. In the long term these activities will convert this unique ecological niche into a desert. Further there is fear of major earthquakes on account of the gigantic dams built in this region. The faults oserved under the Supa dam are indicative of this danger. Together with this, bad management of the forest resources by the people, such as attempts to cultivate hillslopes, deforestation to meet the fuelwood and green manure needs and unrestrained grazing by cattle, goats and sheep have further degraded the Western Ghats.

In Karnataka, the environmental problem has been compounded by the presence of several factories that have been polluting the environment on a massive scale-along the Tungabhadra, at Ammasandra, Nanjangud, Karwar, Mangalore and Bhadravathi. The Kali, Varahi and Sharavathy Projects have caused large scale destruction of green forests. Thousands of hectares of village common lands have been transferred to Karnataka Pulp wood Ltd., a Joint Sector Company for raising of eucalyptus plantations for industrial needs. On the pretext of energy short fall, a nuclear power plant is being planned at Kaiga. The problems of people uprooted from the sites of these various schemes have multiplied over the years and spread from Ramanagar to Kadra, Kodsalli and Kaiga.

After seven months of preparation and involvement of over 150 voluntary organisations Save the Western Ghats March began on November 1st from the southern tip at Kanyakumari and the northern tip at Navapur towards Goa.

The organizers hope and are working towards identifying concerned young men and women who can be important part of this people's movement and can fecilitate the organizing of the affected people who could take initiaive in planting trees on large scale, try to bring pressure on the authorities and preventing further denudaion of the Western Ghats and also bring the Wastelands to productivity to meet basic needs of rural and tribal people especially the poor e.g., fodder for cattle, fuel for cooking, raw material for artisans, small timber for housing, green leaves for manure and fruits. As one organiser said "the basic responsibility of preserving and sustaining the environment and ecology is best left to the people, bureacracy and state playing the role of an enabler (Not produer, as the forest bureacracy has tried and failed). Only awakened people can act as safeguard against further destruction of environment and also regenerate the barren areas to meet their basic needs".

The experiences of the Marchers from both ends will be shared in the two day meeting on January 29 and 30, 1987 in Ponda, Goa. This is followed by a three day Conference, where the Marchers together with other Environmentalists and concerned persons will evolve a long term strategy and possible organizational framework for the Central involvement of people for restoring and sustaining the ecological balance for the Westerm Ghats.

The effort which is taking the shape of the people's movement has the potential to contribute not only to the saving of the Western Ghats, a significant and basic part of .the ecology of the Southern India but also save the whole country and world from the ecological disaster.

Kumar. Kalanand Mani
and Sri. S. R. Hiremath

C/O. Samaj Parivartana Samudaya (SPS)
"Ashadeep". Jayanagar Cross. Saptapur,
*Dharvad-*580001, *Karnataka.*

The Brazilian Horror

"Never have I seen such a tragedy", affirmed the physicist Jose Rosenthal of CNEN (the Brazilian Nuclear Energy Comnusion), referring to the spread of radioactive cesium-137 in the central Brazilian town of Goiama. The accident involves approximately 100 gms. of Cs 137, 'an amount similar to the total Cs fallout on the whole of West Germany following the Chernobyl disaster) and has alredy claimed 4 lives with 40 more hospitalized of whom many are not expected to survive.

In Brazil workers arc legally required to provide their employers with X-ray photographs of their lungs. This has led to the proliferation of private radiological clinics set up by people with lot of money and no scruples. The cesium in powdered form was contained in a lead box found by some men in an abandoned radiology clinic. They sold the lead cask to a scrap metal dealer who opened it. Reports say that people present were fascinated by the luminosity of cesium and started, playin with it. Maria Gabriella, the 6 year old daughter of the scrap metal dealer rubbed the powder all over her body and paid for her innocent, exuberance with her life.

The powder has contaminated a whole neighbourhood. People took the glittering powder home to show it to their family and friends. When the horrible symptoms started appearing they tried to wash it all off thus contaminating the water drains. Then panic gripped the city. Its one million citizens became national pariahs. 30,000 people visited control posts in a ten day period, Business in the city fell by over 60%. Not many people wanted to buy food or clothing for the fear of contamination. Many abandoned their homes. People had to produce certificates from the CNEN testifying their radioactive 'cleanliness'.

The tragedy has highlighted the total confusion and un preparedness of the authorities. When news of the accident became known, 42 technicians from CNEN travelled to Goiania, where many of them worked without proper protective clothing. The machines brought for measuring radioactivity quickly broke down, the measurements were inaccurate and one technician as well as four policemen were contaminated. The patients were transfered in ordinary ambulances which were used without decontamination for days. The hospitals did not have enough disposable clothing nor isolated rooms for the victims. At least two nurses and one doctor were also contaminated.

The problem of what to do with the radioactive waste has not yet been solved. The football stadium where the victims were first brought for checks needs to be decontaminated There were suggestions that it be washed and the grass burnt. Unfortunately radioacctivity cannot be got rid of so easily : The water will run into the sewer system and fire will make the radioactive particles airbourne spreading contamination far and wide. Cesium has a half life of thirty years and thus contaminated material can remain a threat for hundreds of years. It is for this reason that the residents of the city do not want burial of the accident victims in the city cemetry though they have been placed in coffins with layers of lead and concrete each weighing 600 kg.

Source : WISE news communique 281.2428; 282.2843
The Telegraph : 4.11.'87

Protest against Kaiga

Peace activists wearing distorted masks and spotting snappy anti-nuclear badges and T-shirts marched along with their children to Raj Bhavan on November 15th morning, simulating the horrors of a radioactive environment, to oppose the Kaiga Nuclear Plant as well as the ongoing atomic 'projects in the state of Karnataka.

The marchers belonging to the Citizens Against Nuclear Energy (CANE) dropped flat every 50 feet on the way-(they call it 'rod show') stopping curious pedestrians and motorists.

The silent processionists presented a memorandum to Governor A. N. ,Banerji urging him to convey to the Centre their "no" to the Kaiga Plant, Ratnahalli Uranium Plant, uranium mining at Arebail and to the reported nuclear waste disposal plant at Kolar Gold Mines.

A "Statement of Public Concern" signed by 60 prominent citizens and expressing serious concern at the "sudden spurt" of nuclear related activities in the State during the past two years was also released on the occasion.

The statement signed among others by Gorur Ramaswamy Iyengar, Dr. U. R. Ananthamurthy, Prot. Gopalakrishna Adiga, Dr. Siddaiah Puranik, Dr. Shivaram Karanth, Dr. H. M. Nayak and Dr. G. S. Shivarudrappa. It demanded at least a Moratorium on the Kaiga nuclear plant and the Rs. 350-crore Rare Earth Mineral Plant (REMP) at Ratnahalli' near Mysore till au impartial analysis of environmental impact was made, public hearings conducted and a national debate on nuclear energy question held as promised by the Prime Minister.

They also demanded the immediate repeal of the Atomic Energy Act of 1962, release of information pertaining to all nuclear related activities in the State, setting up of ail energy information cell, evolution of methods to expose every MLA and MP to the factual information on energy economics and nuclear truths and. making of the Atomic Energy Regulatory Bo?rd fully autonomous.

Briefing reporters, CANE members Suresh Heblikar, Mr. Nagesh Hegde and Mr. H, S. Doreswamy said the Kaiga plant, besides exposing the forests and the Kali river to radiation, also involved a security risk with the concentre tion of large dams and a naval base.

The Rare Earths Plant at Ratnahalli was consuming 66,000 KW of power from the State grid and one lakh gallons of water from the KRS dam. They maintained that the enriched uranium produced form the plant would be of no use to any of the reactors in the country.

They accused the Government of casting away the basic tenets of participatory democracy in keeping the academic scientists and elected representatives off the information on nuclear planes and indulging in large scale 'disinformation".

Access

We strongly recommend our readers to read Arjun Makhijani's article "Low Level Radiation and Cancer" which appeared in the October 31st, 1987 issue of *Economic and Politick Weekly.* A recently published BARC study by K.S.V. Nambi and S. D. Soman on the relationship between radiation levels and health status in 5 cities in India tried to indicate that higher radiation levels correlate with lower incidence of cancer. Makhijani finds that not only is the data used in the study deficient, but the analysis is faulty and important contributory factors entirely ignored. He calls this paper "a shameful piece "of work presented i*n* the guise of science," which not only discredits the authors but alto BARC (Bhabha Atomic Research Centre) and the referees and the publishers of the Journal Health *Physics.*

Radiating Complacency

The International Commision on Radiological Protection (ICRP) is a panel of experts born out of a gathering of radiologists in 1928 at Stockholm. Supposedly watchdog of public health, they have over the years zealously guarded the interest of the 'experts' (nuclear industry in particular). Below we reprint 3 articles from two magazines which have in the past taken a generally pronuclear stand.

The limits set for exposure to radiation are far too lax

The experts on radiation have got it hazardously wrong. ICRP used to believe that there was a safe level of radiation exposure. Then, in the 1660s, it admitted that the risks of radiation simply increase with the dose received; there is no level of exposure below which radiation is complerely safe and above which it becomes nasty. The commission said then that the change in risk should be treated as smooth, even for small doses. It probably shouldn't be. Some new evidence suggests that risk may even rise faster at low levels of radiation than at higher ones.

For practical purposes a safety line has to be drawn. The ICRP, which is meeting at Come in Italy, is suppased to chalk in that demarcation line. The present line is drawn at 50 milli Sieverts (mSv) a year for those subjected to radiation at work; for members of the public it is five mSv a year, with a recommendation that their average over a lifetime should not exceed one mSv a year. So a worker getting the full 50 mSv a year will in 1½ years suffer the full dose an ordinary person is supposed to be permitted in his lifetime And the permitted limits themselves suddenly look too high for the public, and far too high for the workplace.

The commission is concerned mainly with two things. One is a measure of the link between radiation dose and cancer risk; the other is a criterion of acceptable risk. The "safe limit" is the dose that carries the highest acceptable risk of cancer, The latest ICRP risk estimate (set in 1977) states that if im people each receive a dose of 50 mSv over a year, 625 of them Will eventually die from radiation-induced cancer. So a person who has a year's worth of radiation at the workplace limit faces a risk of death of one in 1,600. Over a working life of just under 40 years, those annual risks add up to a chance of death by radiation-induced cancer of around two in TOO.

Many people now think the risks arc much greater. In 1980 a joint sub-committe of America's National Academy of Sciences and the National Institutes of Health gave a higher risk estimate: between 790 and 2,500 deaths per im per 50 mSv per year. Recent studies of the survivors of the Little Boy and Fat Man atomic-bomb attacks on Japan also suggest that the relation between dose and cancer has been underestimated. More than 800 scientists and doctors have sent the ICRP a petition calling for an immediate reduction of present permitted limits by four-fifths.

It is not surprising that experts differ. They always do. The flaw in the present system is that the particular group of experts that set the international guideline has persistently shown a bias towards complacency. The ICRP played no partin the campaign to stop the tests of nuclear weapons in the atmosphere—tests which, according to some estimates, could by the end of this century have caused up to 3m people to die prematurely. It withdrew its support from the rule which limited x-rays of women to ten days after the start of their periods in order to avoid irradiating a very young embryo. Although nobody is sure that x-irradiation at Such an early stage is harmful, the damage done by x-rays later in pregnancy is proven. The commission is open to the charge that it puts the convenience of radiologists above all.

To deserve public confidence, the ICRP needs either to cut the present limits on exposure to radiation 6r provide a convicing answer to its critics. Widening its membership to include representatives of the public and workers who are exposed to radiation would help.

Source : The Economist (12. 9. '87)

The legacy of the A-bombs

The survivors of the atomic-bomb explosions in Japan are one of the main sources of information about the effects of low-level radiation. Their response to closes of radiation —including quite small ones—has been carefully monitored since the 1950s and is used to work out the likelihood of harm for various levels of exposure. Any reassessment of the Hiroshima and Nagasaki data has an effect on risk estimates in the nuclear industry and in medicine.

Such a reassessment is now underway and many of the results have recently been presented by Professor Edward Radlford, an epidemiologist at the University of Pittsburgh in Pennsylvania. One of the main problems with the data is knowing what doses were received by the survivors. Little Boy and Fat Man, the bombs dropped on Hiroshima and Nagasaki respectively, were, after all, the first of their kind. The radiation characteristics of Fat Man, a a bomb that used plutonium, were well enough understood for dose figures for various distances from ground zero (the point on the ground directly' below the explosion) to be calculated. Little Boy was a different sort of bomb, using uranium. For some time it had been thought that the two explosions were different, in that Little Boy gave out more of its radiation in the form of fast neutrons than did Fat Man. Now it appears that the harm done by neutrons was about the same in each of the explosions.

This has two main implications. One is that more of the cancers found in the population of Hiroshima than were previously thought were caused by electro-magnetic radiation (that is, gamma rays and x-rays which are more common in everyday-life than are fast neutrons). The other is that the statistics on cancer rates among both Hiroshima and Nagasaki survivors can be pooled, allowing more reliable measurements of the relation between radiation dose and cancer.

'the dosage levels received by the victims of Hiroshima are also being recaculated. New evalutions of the shielding provided by moisture in the air—it was a hot, muggy day-have almost halved the estimates of radiation dosage received. The incidence of cancer may have been underestimated, too. Some forms of cancer can sometimes be overlooked. They turn up more often in careful autopsies than on routine douth certificites. Among the cancers that appear to have been underestimated on Japanese death certificates arc those of the lung, liver, pancreas, prostate and urinary tract. This has made it hard to derive figures about the relative susceptiblity of various body tissues to radiation-induced cancer. For example, if figures from death certificates are used, no significant relation between prostate cancer and radiation dose is found. If figures from the special tumour registries in the two cities are used (these are more accurate and also include non-fatal cancers) a relation between cancer and radiation is found.

Another reason that estimates have been low is that the survey, unfortunately, is not yet finished. The cancer rate in the two cities is still above average. Most distressingly, the Cancer rate for people who were under ten in 1945 is very high, eight times higher than that for those who were over 35. This provides an illustration of the way that sensitivity to radiation depends on age, and shows that children are particularly at risk.

Another fact to be considered when looking for lessons from the bombings is the general health of the sample population of survivors which, five years after the bombing, was better than normal, insofar as their death rate was below average. As well as radiation, they had survived fire, blast, exposure, hunger and extreme grief and stress. A large number who survived the immedate effects of the bombing had soon died of a variety of common diseases; many died who might otherwise have developed cancer. Thus the five-year survivors were a rigourously selected group, not a typical population. Some scientists suggest that more accurate figures may eventually come from studies of the 135,000 people who were evacuated from the Chernobyl area.

That evidence will take many years to arrive, until then, the survivors of Little Boy and Fat Man will continue to dominate thinking about the effects of low-level ionising radiation. Professor Radford argues that this evidence, as it now stands, clearly shows that the risk estimates sanctioned by the International Commission on Radiological Protection are too low by a factor of as much as ten.

Source : The Economist (12. 9. '87)

Rethink on radiation dose limits in Britain

The British government is likely to amend its present radiation dose limits following advice from National Radiological Protection

Hoard based on information from a preliminary reassesment of fatal cancers in the surivors of Atomic bombs.

In September ICRP concluded that the results of the Japanese study raised the risk estimate for the exposed population approximately twofold. The ICRP decided against immediately recommending a change in dose limits and will not issue new advice till it has completed a review, likely to take at least two years. NRPB is recommending an annual dose limit of 15 mSv for radiation workers and 0.5 mSv for members of the public. (The present limits arc 50 mSv and r mSv respectively.)

Revaluation of the Japanese data means that the risk associated with continuous exposure at the occupational dose limit of 50 mSv per year has increased from 1 in 2000 per year to about 1 in 700 per year : a level of risk that "verges on the unacceptable" according to Roger Clarke NRPB's director.

Source : Nature 330, 304, (26.IT.'87)

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The only Source

A. common refrain in the sales pitch of nuclear advocates is that nuclear energy, whatever its problems today, is the only energy source capable of meeting future needs. Dr. Raja Ramanna, the earstwhile Chairman of the Department of Atomic Energy (DAE), made this claim a number of times. In his words, "Nuclear power is the only option for meeting the future needs of power in the country. We in India must not miss this new industrial revolution; for if we do we are bound to lead ourselves to total economic disaster." Sales people are notorious for their zeal. They skip over the 'small print'. Consumers on the other hand, need to be cautious and pay special attention to the small print, or else they risk being taken for a ride.

Before we get into the argument regarding the innocuous-looking "only" one point needs to be clarified. People do not need energy perse : They need energy to accomplish certain tasks e.g. lighting, cooking transportation, manufacturing etc. Electricity is well suited for certain applications and not so well suited for others. In any case, only about one sixth of the country's total energy needs are met by electricity at present. Nuclear power can deliver energy only in the form of electricity. Thus it is clear that nuclear power can never be the answer to *al]* our energy needs. However, let us examine a much narrower claim : can nuclear power totally satisfy at least our eleccricity needs of the future?

What is the situation with regard to electricity consumption today? Barely 2% of the electricity consumed in the country today comes from nuclear reactors. The rest 98% comes from coal (75%) and hydroelectric (33%) plants. Thus, coal and hydel power arc well established and proven technologies. New ways of producing electricity based on the sun, wind and bromass make a negligible contribution at present.

The first contention of the pro nuclear argument is that after, twenty years of almost 'heroic effort nuclear technology has attained the status of a mature technology. "Nuclear energy has been established as an economically viable, competitive source of power." This bold statement often loses its strength in all the moaning about teething troubles which are invoked to explain away the poor performance of our nuclear units. However, for the sake of argument we shall assume here nuclear technology to be fully mature with all the teeth (including wisdom ?) fully revealed,

A change from a mere 2% contribution today to an overwhelmingly dominant role in the future would indeed be revolutionary. The nucleocrats justify this proposed change on the grounds that non-nuclear sources suffer from short comings that prevent their continued expansion. These short comings arc of two types *

1) Limited potential and an uneven geographical distribution : Thus, although only 17% of the total estimated hydel potential of 75000 MW has been tapped till now, expansion beyond 40000 MW is considered unpractical since most of the hydel power sources are concentrated in the Himalayas, far from the consuming centers, and transmission losses pose a great constraint. Similarly, although the country has large coal deposits (enough to last a thousand years at present rates of consumption) a greatly expanded programme of electricity generation based on coal could lead to depletion of the source in just a hundred years Again, most of the coal deposits are concentrated in the eastern region

11) Environmental hazards Large dams cause extensive damage to ecosystems m then vicinity and change the health, productivity and ecological balance of downstream areas coal is difficult to mine, handle and transport and its burning produces a heavy burden of wastes and pollutants.'

Curiously,' nuclear power does not stand up too well either under an examination applying the very same cuteria that are used by pronucler people to reject coal and hydro electricity. The environmental hazards of nuclear power shall be a constant refram in *Anumukti* and we pass over them now without elaboration Since only a relatively small amount of nuclear fuel (compared to coal) is needed in a nuclear reactor, at first glance it seems as if a reactor can be set up anywhere thus reducing the adverse effects of uneven geographical distribution of other power sources In practice, the requirement nearby of a large body of water (sea, lakes etc) for cooling and big enough electricity distribution grid severely restrict the choice of site. Nuclear power requires a very large infrastructure and as time goes on the availability of this infrastructure begins to act. as a magnet for future nuclear growth. Thus, the trend worldwide has been towards clustering rather than dispersal of nuclear reactors. This clustering is sought to be justified on safety considerations since the transport of spent fuel is specially hazardous. For whatever reasons the fact remains that given time nuclear power plants start showing the same uneven geographical distribution as large hydroelectric plants.

The constraint on expansion arising from limited availability of raw materials, applies far more crucially to nuclear power than coal since uranium deposits in the county are far more scarce than coal. If DAEs current plan of generating 10000 MW does become a reality, the uranium deposits will be exhausted in a mere 30 years. Thus, on all counts, whether of limited expansion potential, geographical maldistribution or of environmental degradation, all the "mature" technologies suffer from equally serious short comings.

At this stage of the argument the nuclear advocates bring out the joker from the pack. Although, they say, the uranium supplies are just enough to sustain generation of 10,000 MW for 30 years, during this period such a programme would result in the production of 3200 kg. of plutonium every year. This plutonium after reprocessing would enable the setting up of one 1000 MW fast breader reactor (FBR) every year. An FBR produces more fuel than it consumes and in a programme based on FBR's even the country's present uranium supplies can sustain a much larger (a 250,000 MW) electricity generation. Besides there are vast quantities of Thorium available 111 Kerala, which with the help of plutonitun produced by fastbrecders will allow an even larger programme in the later half of 21st century. With visions of 350,oooMW (i.e., around 350 tunes the present production), one is apt to overlook the fact that the vision depends not on the mature nuclear technology but on a wholly different beast not yet fully recovered from its birthpangs: the fast breeder reactor. The only statement one can make with no fear of contradicton about the fast breeders is that their teething, growing, adolescence, marital, menopausal, senility problems all await us in the future. Only France has built one FBR, on anything like a commercial scale and that reactor has been beset by many problems. The capital costs of FBRs are much larger than the already sky-high costs of thermal (ordinary) nuclear reactors and that by itself makes the electricity produced in breeders at least twice as expensive as that generated in ordinary nuclear reactors. The financial disaster they portend is not the only reason to be vary of the fast breeders. They have many unresolved safety problems : for instance, unlike the thermal nuclear reactors, FBRs can explode like nuclear bombs. But even if all the safety problems are satisfactorily resolved, au unlikely eventuality as Chernobyl and other disasters teach us, FBRs still pose a very serious threat to society. Defending the weapons grade plutonium they produce in large quantities, from theft, sabotage and terrorist attacks would be a horrendous safety problem requiring imposition of police-state measures.

What do the pronuclear people have to say about the potential of the newly emerging electricity generation technologies based on renewable resources ? One of the most attractive characteristics of sources like the Sun, wind, small hydroplants and biological wastes is their wide-spread geographical distribution and the very short time it takes to put up a generating unit. These sources are nobodys monopoly and lend themselves rather easily with very little environmental disruption to small scale electricity generation to meet local (village-level) needs. Their costs too have rapidly come down in just the last decade because a Utile more money has been invested in their research Thus, they arc ideally suited to meet the future electricity as well as other primary energy suited to meet the future electricity as well as other primary energy needs of Bharat. unfortunately, the very diffuscness of these sources is an anathema to the nucleocrats their whole thinking is geared to a few large units producing hundreds to thousands of Megawatts, with everybody in the country tethered to a grid and they themselves in control. Such a large format power distribution system, incidentally, has its own disadvantages universally. But particularly iu India, which has experienced three wars in three decades, and where the best of technologies are put paid to by inadequate maintainance, smaller generating uinits with some surplus capacity for needs of neighbouring areas, seem the ideal solution. The nucleocrats consider all such technologies only in terms of their Potential for bulk production and reject small scale units on the following counts :

i) They arc as yet unproven
ii) They are as yet uneconomic
iii) In the bulk production mode , they too cause environmental problems due to excessive land use, etc.

There arc both sensible and silly ways of producing clectricity. Ways which arc in harmony with both the nature of the source (diffuse/intense) and also with the cultural living patterns of the people who are going to use the energy produced arc sensible; those in disharmony are silly. For example an array of thousands of synchronised mirrors concentrating sunlight on a huge tank of water to produce steam, is as silly a way to boil water as a nuclear reactor. For one thing, it suffers from the same high capital intensity, long construction times, inflexibility and similar other problems that beset nuclear energy.
The point to note is that even these admittedly silly ways are cheaper, certainly more 'proven' and ultimately less threatenig than the fast breeder. That this is not a mere pipe-dream can also be easily proven. In California alone, for instance nearly 10000 MW of new electricity generation capacity based on renewables has come up in the last six years.

Indeed the answer to the question of just what electricity source would meet our future energy needs would depend on the kind of society we want to build. A society of conspicous consumption and conspicuors waste in which all production is centralised, in which the demands of bulk consumers get preference over the small needs of the masses, in which a handful of people control the destinies of many, which has a large paramilitary and military apparatus safeguarding the security of the state, whose nuclear arsenals arc a constant threat to its neighbours...such a society may feel the need to pursue the nuclear path.
But for a just and equitable society as envisaged by the founding fathers of our nation, nuclear energy is a dead end route, and the quicker we abandon it the better *S. N Gadekar.*

Objectivity Meltdown and Obsessive Cynicism

A rather provoking article by Joe Kramer appeared in the March 1987 issue of the magazine of American Journalists, *The Quill.* "The Objectivity Meltdown" was apparently meant to ridicule efforts like *Anumukti's* to provide the public with unbiased information regarding nuclear energy. Once you realize, however, that Kramer is the press spokesman for the Wolf Creeck Nuclear Power Plant in Kansas city Missouri, you will appreciate that the article was written in real earnest.

Kramer admits his bias openly. So the anti-nuclear reader would feel like saying "No wonder!" But the argument turns pretty soon against anti-nuclear attitudes. For Kramer 'discovers' vested interests on the side of the critics of nuclear power :

> Leaders of the anti-nuclear power movement arc inclined to ponray themselves as mankinds saviours.. The antinukes describe themselves sanctimoniously and uisarmingly as consumer advocates, environmentalists, public interest activists, industry critics. But they have no more claim to moral superiority than do the nuclear scientists and industry spokesmen who arc made to look sinister by comparison because they arc on somebody's payroll....

We would do well to remember, though, that not only is this argument old, it is also specious, because there is no essential connection between being paid for work and the nature of anti-nuclear protest. Kramer tries to assign the same questionable motives to the anti-nuclear protester as those that have been known to activate the supporter of nuclear power. And it is patent now that the supporter of nuclear power as a class refuses to take into account the lasting human considerations (as opposed to commercial or other short-term considerations) regarding consequences of nuclear proliferation. As for professionalism, we wish that antinuclear protesters were more professional than they are now !

As for financial backing and power, a comparison of the production quality of *Anumukti* with that of *Nuclear India* will reveal without doubt all that goes by way of advantage, which the words of Dr. Raja Ramanna, for instnee, enjoy. Such advantages of establishment backing do not restrict themselves to the nuclear concern. And incidentally, could a pro-nuclear estblishment ever afford to keep spokespeople candid in criticism of shortcomings and dangers inherent in the nuclear idea and nuclear technology? Witness also the expensive powerhouse of administrative, legal and para-military and military support which governments committed to nuclear energy have had to call upon all the time. Whatever can be these attractive carrots that tempt the anti-nuclear workers, we wonder, for kramer says,

> Anyone who works professonally against nuclear power is getting a paycheck just as surely as is the person who works to gain acceptance for nuclear power.(-p.15)

We notice, by and bye, that Kramer becomes more direct. Behind the activities of "the anti-nuke gurus" he discovers hidden agendas with the help of which they deceive and misuse "their fearful followers". Some of them even, he says, have "fairly radical goals". Well, the avowed agendas on both sides, pro and anti nuclear power, are quite obvious. Undeniably, too, some on both sides may possess questionable motives; such motives arc hardly an anti-nuclear monopoly! To eradicate doubt in the minds of readers of Anumukti, all the same, we state in plain terms our motive and agenda (that is, if the title leaves them in any doubt) : liberation from a nuclear policy which implies a centralisation of nuclear power (in terms of its political ant! economic power), neglect of the interests of the majority of the population for the benefit of a few, disregard for human and environmental health within and outside the country. Admittedly, these thoughts are bound to appear radical to those staring at illusions of a nuclear paradise in the 21st century.

Having thus cleared *Anumukti,* we hope, of the bias of "the antinuclear power people and their misleading views," let us proceed to the way Kramer discredits the journalists reporting about nuclear accidents. Kramer, who himself had been a newsman for long years, is concerned about the missing professionalism, i.e., objevtivity, of his former colleagues : they "glamourize" the anti-nuclear movement, because this serves to make their stories sensational; they rely on anti-nudbar. informstion in a disproportionate way and this reliance results in an "all-too-obvious anti-nuclear tilt" in the media. They do not just report what *has* happened, but they have gone *so* far as to stress the "what-ifs".

In a letter-to-the-editor appearing in the May number of *The Quill*, the journalist Timothy Lange from the *Los Angeles Herald Examiner* explains how what Kramer calls his "obsessive cynicism on the nuclear power issue" developed :

> ..after a few years of catching spokespeople for the industry and the Atomic Energy Commision in repeated distortions and outfight lies, I began to question the bright-new-tomorrow press releases I had once swallowed so eagerly.

Is this "healthy scepticism, the hallmark of American journalism",which Kramer misses in the reporting of the media on the Three Mile Island and Chernobyl accidents, wrong if it slowly discovers the unholy alliance between governments and nuclear industry ?

> Timothy Lange : "My scepticism turned cynical arter I became better acquainted with the frightfully scandalous history of the nuclear industry and the relevant federal bureaucracies without which commercial atomic power would never have been developed."

Tom Gardner, writing for the Union of Concerned Scientists, which has been severely criticised by Kramer for its anti-nuclear position, underlines Lange's argument and shoots back :

> Kramer is off base in suggesting, with no evidence, that media coverage of nuclear energy exhibits an intentional bias against nuclear power.. 'Kramer's article is a good example of why experienced journalists don't just wrap up their stories and send them to their editor after talking to the local utility spokesman (p 10/11). (In the US electricity is supplied by private utility companies.)

In the *St. Louis Post-Dispatch.* Patricia Tummons, defends a critical approach to the nuclear issue by noting that :

> Responsible repotting on any undertaking that has potentially devasting consequinces for the environment must address this issue.

i.e., even profession al journalists have to go beyond just describing the disasters that had happened so far. They have to warn as well.

What does the other side say ? Here is Dyek Smyser, of *The Oak Ridger,* Tennessee, who characterises himself "as a newspaper editor for nearly 40 years in' a community whose reason for being is nuclear technology, as a personal friend and neighbour to hundreds of persons involved with that technology".

Smyser, who has "felt the same frustration that Kramer has", also observes that the media have resorted far too, often to discusions of *the "what-ifs"and he explains this situation* by the *fact* that no "what-as" i.e, objetive statements of nuclear catastrophies, was available. With Chernobyl the situation has changed

> To the extent that Chernobyl furnished facts rattier than speculation about the causes and effects of a nuclear power plant disaster, it could contribute significantly to a more accurate public conception of nuclear power,

While the surprised reader of this letter still wonders what the victims of the Chernobyl disaster and the consecutive dislocation would think about this statement, Smyser criticise? the anti-nuclear "mind-sets" of the media :

> . .has any other mind-sot about a scientific and technological question been so at odds with the great majority of experts in the field as is the anti-nuclear power mind-set ? Alvin M. Weinberg, former director of Oak Ridge National Laboratory and perhaps most reascned pre - nuclear scientist in the country, feats that this antinuclear power mind set is about to fore-close the nuclear power option for the US, at least for the next half century or more

It seems that Smyser overestimates the role and power of the media when in quoting Weinberg, he apparently evokes the spirit which endangers civilisation.—A point which resounds in Smyser's letter is the main topic of several other contributions to the discussion in *The Quill* in the first half of this year. These writers express their concern over a gap in the communication between scientists and journalists. Science, which has gained such an eminent role in our modern world, is given far too little importance in the media. However, media which depend on a consuming public, are able to give science or technology their due place only in the context of spectacular events like accidents in nuclear power plants.

This misinformation results in a phenomenon which Kramer calls the "Hiroshima Syndrome", the disability to distinguish between nuclear power and nuclear arms. Finally, the naive uninformed public gets frightened about anything connected with radiation, says Kramer. Considering the natural radiation which we arc exposed to, we should remain calm about such low doses of additional radiation as arc due to nuclear power plants. As the crown witness he quotes Dr. Robert Gale, the American bone-marrow expert who had rushed to USSR after the Chernobyl disaster in order to help Russian doctors *there :*

> The long term consequences. .would be less than those expected from the burning of coal to generate electricity.

What this comparison means in actual terms, Dr. Gale explained at another place, (here quoted from *Atom,* the journal of the British nuclear stablishment) :

> in the USSR about 20,000 deaths might occur in the next 50 years because of Chernobyl. The replacement of nuclear by fossil fue would result in approximately, one million deaths in this period, if one Chernobyl-type accident is assumed.

Yet, Dr. Gale's statements and activities have been too contradictory not to be regarded with a lot of caution. But Kramer goes even further than Gale, stating the near to-absolute safety of nuclear energy :

> The consensus of most radiologists and radiation biologists is that the increase in long-term cancer deaths as a result of radiation from the Chernobyl acident will be of such a low order of magnitude that it v ill be difficult if not impossible to detect statstically

And such words from the pen of a man who just has reproached the press of being cynical ! A similar thought-lessncss-or is this intended ?— appears in the letter of Bertram Wolfe, President of the American Nuclear Society, who argues, that Chernobyl cannot happen in the U.S.(on specific technical reasons). He says:

> In a sense the Chernobyl accident is an affirmation of the more careful and expensive approach to factor safety in the US ___

This sentence, in a way, echoes Du. Ramanna's words :

> After the Chernobyl accident, I must say that most of our newspapers have taken the accident in the proper perspective i.e. to consider as *a* part of the learning process of the world. Future reactors will surely operate more safely under any circumstances as time goes on..

It seems that a long time before Kramer discovered the "objectivity meltdown", as he calls his article, the virus of cynicism has caught hold on a nuclear establishment which, after failures in the technical and economic fields, has suddenly become vulnerable to public criticism.

We should like to suggest,inost humbly of course, that the foundations of the pro-nuclear establishment have been shaken by the major disaster of Chernobyl. (It could, but naturally, be immensely more disastrous if such an accident were to occur in an otherwise technologically backward country such as India or Pakistan.) We may hear, in the voices of the Kramers of the nuclear establishment the high notes of an anxiety no longer deniable after Chernobyl. The anti-nuclear protesters did not *need* the Chernobyl disaster for their warnings ("what ifs"). The pro-nuclear establishment can only lose ground heavily with such an incontrovertible disaster. Try what they might, they can only resort to sarcastic rhetoric against anti-nuclear protests. And if the issues were less fundamental, we might feel satisfaction in the strident tones of Kramer. Our concern is so creat, however, that we cannot rest contented at this sign of panic,

Sources : Joe Kramer "The objectivity meltdown", in : *The Quill, March* 1987, vol. 75/3, p.12-17. Tom Gardner. "Take the pro-nuke argument with many grains of salt", in : *The Quit.,* April 1987, vo. 75/4y p. 10-11, Letters to the editor *in* : *The Quill* vol. 75/4-5. Raja Ramanna. ',The nuclear power is the safest and most economic form of producing electricity", excerpts from a speach held in Bangalore on 10 Sept. 1986. Note on Chernobyl in *Atom,* August 1987, No. 370, p. 31.

JOIN

ANUMUKTI

A JOURNAL DEVOTED TO NON NUCLEAR INDIA

WITH SUBSCRIPTIONS, CONTRIBUTIONS AND DONATIONS

NUCLEAR SELLING CAMPAIGN

The newly-constituted Nuclear Power Corporation has drawn up a 15-ycar plan to generate 10,500 MW that is, a tenfold increase of current capacity, and is envisaging an investment of Rs. 10,000 crore. The NPC has an authorised capital of Rs. 2,000 crore and will be in charge of the design, construction and running of nuclear power plants.

According to the chairman, the setting up of the corporation will facilitate, it to achieve two objectives : ensuring high operational efficiency of the power units and the completion of new projects expeditiously. In other words, the setting up of a corporation is a big step towards achieving the 21st century nuclear Utopia.

It may well be that the corporation will indeed have a greater degree of flexibility than had the Nuclear Power Board, its predecessor which was merely a component of the department of atomic energy. But it is highly unlikely that in a sensitive area like nuclear power the corporation will have any real degree of autonomy in decision-making. Moreover, the inefficiency apparent in the planning and construction or the functioning of nuclear plants is hardly because the NPB has been hamstrung in making vital decisions. Similarly, unless the corporation is structurally reorganised thoroughly, project management or construction efficiency is not going to be streamlined. And this, given its mammoth size and the need ro centralise most of the authority, is not a probability. Quite clearly the constitution of a corporation is mainly for the purpose of being able to tap public funds. Of the investment planned, 37 per cent is to be generated from its internal resources, 30 per cent from government loans or equity and the rest is to be met through market borrowing. The corporation will issue, public bonds—by the end of December 1987-to raise a capital of Rs. 100 crore.

It is with the bond issuec in mind that the chairman has urged the NPC to 'educate' the public about the plants, their operation and their impact on the environment. He has suggested that people living around these projects should be told about what is going on within the plants. Does this mean that the nuclear establishment is, at long last, prepared to divulge information regarding the status of the nuclear power industry in India ?

If the PR effort which preceded the inauguration of the NPC is any indication, all that this new outlook means is that we will now be subject to an intense and determined disinformation campaign. For it is quite ironical that the chairman should even mention the need to be more open. No corporation which is hoping to raise funds from the public can afford to draw attention to its weaknesses., its inefficiencies and the possible hazards it poses. What is required in the circumstances is a neatly tailored PR campaign to 'sell' the idea of nuclear power, which is precisely what we can expect in the months to come. This in turn puts a greater responsibility on those who have reason to be cautious and critical about nuclear power to separate fact from fiction.

Upto now the anti-nuclear groups in the country have been hampered by a dearth of information; now they will have to cope with a barrage of disinformation.

SOURCE : Economic & Political Weekly (7. 11.'87)

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ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Vol. 1 No. 4 **February 1988**

'That *corpse you planted last year in your garden,*
**Has it begun to sprout ? Will it bloom this year ?*
'Or *has the sudden frost disturbed its bed* ?
'Oh *keep the dog far hence, that's friend to men,*
'Or with its nails he'll dig it up again
The Wasteland *T. S. Eliot*

A reader, Shri. R. K. Patil of Nagpur has written in to ask, "Is it possible to dispose radioactive waste in a manner non hazardous to human health ?'' The answer in one word it *NO.* The answer preferred by the nu:lcar establishments is 'not yet' with the stress on yet. Thus the dispute is not about the *fact* that there is no known way of getting rid of the large piles of these hazardous substances. Now can there be much disagreement about the seriousness of the danger posed by these intractable and highly toxic pollutants. The newspapers have *been* full of stories which highlight this aspect—from the Brazilian tragedy where ignorance, exuberance and a mere 100 gnu. of Cesium-137 combined to make pariahs of the one million residents of Goiania to the West Germ in scandal where old fashioned bribery has played havoc with the supposedly 'foolproof full-scope safeguards and one finds hundreds of bombs' worth of plutonium and uranium simply 'missing'. Reports speak of its appearance in Libya and Pakistan—but that is all old hat. In the nuclear age of 'plenty' for everyone, the question is—do the PLO, LTTE, GNLF, XYZ...have the Bomb ?

The only point of controversy then is about the timeframe in which a solution might be found. Nucleocrats usually claim that a solution is just round the corner. With touching faith they assert that technology itself shall solve (as it always has) the problem it has spawned. All they ask for is a little forbearance. Some more time to do mote 'research.'

In a trivial sense the solution to the problem of radioactive wastes has always been known. It is just to wait and do nothing. Radioactivity is the result of energy 'shedding' by unstable nuclei of atoms. Over time these nuclei naturally decay and the activity of given mass decreases. However, since radioactivity is a nuclear property and has nothing to do with the electronic configurations of the atoms (on which chemistry depends) there are no chemical means to speed up the process of radioactive decay. Thus the problem of 'disposal' of radioactive wastes becomes one of how to isolate the waste and keep it from contanianating the environment for the millenia it takes for the man-made radionuclides to naturally decay.

'solution' which just two drendes ago looked very promising now appear dangerous. In face, greater knowledge has made the problem more and not less intractable. Recent developments in applied mathematics seem to suggest that "some forms of environmental unpredictability are intrinsic and hence incurable." The irresistable force of scientific omnipotence has met its irremovable object—dangerous objects which won't stay put.

In the meantime; scientists research, nucleocrats bring out new public relations gimmicks an*d* antinukes protest : while the wastes pile up day by day.

Surendra Gadekar

Anumukti deeply mourns the death of Dr. A. K. Ganguly who was a friend, teacher and a valuable ally to many voluntary environmentalist organisations in the country. A pioneering environmentalist, it was he who established the discipline of Health Physics in India. The courage he displayed in refusing to compromise his rigourous stand on safety no matter what the pressures, whether political as in the case of Narora, or from peers as in the case of radiation exposures at Tarapur was indeed exemplary.

LETTER BOX

Anumukti, I assume is addressed not only to a small circle of experts or those who have been interested in the topic for a long thru. Therefore it would be important to have an introduction to technical terms at least in one issue of the journal. An introduction to the scientific and technical background of the subject would help newcomers to understand the subject matter. With such a basis a wider cirle of readers could be addressed. Secondly, informartion about and analysis of the connection between nuclear energy and nuclear arms is important. In addition to this a discission of the alternatives is absolutely neccesary. Reports about activities concerning solar, wind or hydro-energy should be included in the journal as a constuctive criticism of atomic energy.

Markus Schuetterle
Matara, Sri Lanka

It was a welcome surprise coming across the article "Save the Western Ghats—March" in Anuraukti vol t no 3. With succeeding Indian Governments accelarating our suicidal take for technological parity with so called 'developed' nations, the quality of human life now and in the future stands threatended from various angles. Nuclear power is just one of these, and if a movement against it does not interrelate with other similar movements, a united forum of protest cannot be forged.

Another sad fact is that the lack of a proper communication system enables the people in power to proceed in blithe disregard of public interest and public opinion fails to get properly mobilized. Movements like 'Chipko' stand out as beacons of encouragement for other movements. The lesson is that with perseverence, motivation and the involvement of the common people (whom these projects hurt most), the voice of reason can be conveyed loud enough for those in power to take note.

I hope that Anumukti not being a journal only devoted to a non nuclear India, will continue to include similar articles and news-reports of protest movements and help to bridge the communication gap that exists.

Abhijit Das
Varanasi

DEADLY CROP IN THE TANK FARM

The safe storge of radidatire wastes is not a problem of mere academic interest. It effects us all Below we present a shortened summary and some of the conclusions of a no *page report prepared by Dr. Arjun Makhijani, Robert Alvarez and Dr. Brent Blackwelder for the Environmental Policy Institute. The report is based on official documents obtained through requests under the Freedom of Information Act. The report describes the operation of an existing nuclear facility in South Carolina. It contain. many lessons for us in India.*

Eight hundred trillion curies *of* deadly high-level radioactive wastes are stored in the Savannah River Plant (SRP). Although 27 million gallons of these wastes constitute about one third of the total volume of military high-level radioactive wastes in the U.S., they contain about 78 percent of the total radioactivity in all U.S. military high-level wastes. SRP's high-level wastes pose a serious threat to the plant's workers, to the people who live in substantial portions of South Carolina and Georgia, to future generations and to the environment. The rates of radiation-related cancers among workers are already significantly higher than expected. The plant site borders the Savannah River and sits atop the Tuscaloosa aquifer, one of the most prolific and used sources of fresh water in the eastern United States. The 300 square mile site and the shallow aquifers above the Tuscaloosa are so severly contaminated that it is reasonable to conclude that it has been treated by the federal government as a national sacrifice area for the U.S. nuclear weapons program.

The high-level radioactive wastes which continue to build up at the Savannah River Plant result from the production of radionuclides for the U.S. nuclear weapons program. In particular most of the wastes come from the production of plutonium in nuclear reactors and the subsequent reprocessing of the reactor fuel rods in chemical separations plants. The SRP is owned by the *U.S.* Department of Energy (DOE) and operated under contract by E.l. du Pont de Nemours and Company (DuPont). Most of the major equipment - such as the reactors and reprocessing punts, as well as many of the tanks, date back to the 1950s. This is a field in which technological change and safety standards have changed rapidly. Yet in recent years the basic approach to watte management at the Savannah River Plant Tank Farm has changed but little. In fact. the operating record of the obsolete facility shows that its very design basis was faulty and dangerous.

There is also substantial evidence that these problems have been compounded by unsatisfactory management in many areas crucial to safety. Both Dupont and DOE appear to be more anxious to minimize any adverse consequences and thus allay public fears than to address operating problems and risks from accidents in a scientific and technically responsible manner.

We summarize the issuse under the following four headings :

o Routine Environmental Contamination
o Accidents and Risks
o Worker Exposures and Cancer Risks
o Long-Term Management

Routine Environmental Contamination

The design of the Savannah River Plant assumed that radioactive wastes could be routinely discharged into the soil because the soil would trap them and prevent them from contaminating water supplies, particularly in the case of some of the more deadly materials like plutonium and ccsium-137. Little thought appears to have been given to pollutants from non-radioactive toxic materials and less to interactions between the two kinds of pollution.

Time has shown both the design premise and the omissions to be serious errors. Radioactive materials and non-radioactive toxics have contaminated the shallow aquifers beneath SRP. Interaction between solvents and plutonium has caused it to migrate into the groundwater in twenty years-compared to a predicted time of hundreds of thousands of years. Despite repeated internal and external efforts to stop these dangerous and technically obsolete and erroneous practices, Du Pont and DOE continue routine discharges of toxic materials into the soil.

lf tho SRP site is not to become a permanent national sacrifice area, a massive clean-up of the site will be required. DOE has estimated that the first seepage basin cleanup would require a billion dollars. The problem of clean-up is bound to be severely complicated by a lack of data and unreliability of such data as there is.

We have two widely differing estimates for plutonium in the high-level waste tanks. Data in DuPont Safety Analysis Report (issued in 1978) yields, an estimate of about 170 Kilograms of plutonium containing 300,000 curies of radioactivity, for 1980. However, in 1980 DuPont supplied an estimate of 1 million curies of plutoium - about 400 Kilograms - to the National Academy *of* Sciences. This enormous discrepancy, serious both for plutonium accounting from the security point of view, and for its potential environmental consequences, is unexplained.

Accidents and Risks

Some of the most technically difficult aspects of waste management at SRP have to do with the problems associated with accidents and risks to the public and to future generations.

Consider, for example, the question of hydrogen build-up in the high-level waste tanks due to the action of radiation on hydrogen-containing chemical compounds in the waste. A build-up of hydrogen to high enough levels, due to partial or total failure of tank ventilation systems for example, could cause an explosion severe enough to destroy the tank and send millions of curies of radioactive waste spewing into the air and onto the land. Such an accident could cause up to 20.000 cancer cases in addition to genetic damage and other ill-health effects. In addition, a very large area of land would have to be written off essentially for ever. It would also have unpredictable repercussions, possibly very severe, for groundwater contamination.

The DOE and DuPont approach to such accidents irresponsibly assumes that groundwater contamination can be ignored as "insignificant" because the soil will retain the radioactive wastes. This assumption has been shown to be invalid by SRP's own operating experience and has been criticized by the U.S Geological Survey, DOE and DuFont-also-assume that water me patterns and many other. factors will not change significantly *fat* a hundred years or more. This is not merely arbitrary, It is contrary to evidence. Water use patterns have changed immensely in the past few decades with DOE and irrigation being major contributors to that change. Indeed, in other reports, DOE plans on continuing to contribute to signifiant increases in water use.

SRP was not designed to withstand severe earthquakes. In the last few years, howcvcr,both the U.S. Geological Survey and the Nuclear Regulatory Commission have concluded that severec earthquakes, comparable to the one in Mexico City in 1985, cannot be ruled out. The Nuclear Regulatory Commission has criticized the SRP assumptions of moderate earthquakes at most, to "contain a strong element of speculation." A severe earthquake could cause millions of curies of radioactive wastes to contaminate the air, soil, and water of the area. Even using the non-conservative assumptions of DuPont and DOE, it would cause from IT,OOO to 230,000 excess cancers and up to 2,500 genetic defects in future generations. The direct cost, moderately estimated, would be from 5800 million to $14 billion-excluding the cost arising from writing off of large areas of land, from contamination of water supplies, from property, agricultural, and business losses.

Current law specifies maximum DOE liability as $500 million. DuPont is exempt from liability to the public in the event of accidents, earthquakes, and other catastrophic events. It exempts contractors from liabilities arising even from their own negligence.

Worker Exposures and Cancer Risks

Workers at SRP receive considerable doses of radiation just by being on the site because of routine emissions and radiation from site contamination. These doses averaged about 150% more than the doses received off-site from background sources. In addition, various types of work involve additional exposures.

The external radiation doses to SRP workers alone can be expected to cause between *16* and 330 excess cancers among SRP workers, with more than half of these expected among, waste and reprocessing area workers. Already there are definite indications at SRP and at other DOE owned nuclear facilities around the country that workers are contracting and dying from radiation related cancers. Some examples :

- o At SRP, the incidence of myloid leukemia has been more than double the expected number (6 occurred versus less than 3 expected.) :
- o At the DOE owned Oak Ridge Gaseous Diffusion Plant, a study found "excess deaths due to lung and brain cancers and respiratory disease..."
- o A study of 2,509 DOE workers exposed to more than 5 rems between 1947 and 1978 showed a rate of cancer of the rectum at three times the national average among them.

The emergence of an alarming pattern of excess cancers has elicited a curious response from DuPont. An internal 1976 study by DuPont found "evidence...that lung cancer and leukemia were significantly increased..." among workers. Instead of publishing the study, DuPont attempted to erase the significance of its findings through statistical manipulations. Even an adisory committee to DOE found these manipulations "inappropriate," and recommended that the data be reanalyzed by a non-DOE/DuPont group.

The data themselves are not in good shape. One of the principal sources of data-the computerized Data Bank for accidents and non-routine maintenance is missing thousands to tens of thousands of entries. Moreover, there is very little data on interal radiation exposure-through inhalation, ingestion and wounds. Most of the reported data is gathered by obsolete and discredited methods. This is a crucial area for evaluation of safety practices, and liability, since internal exposures are emerging as a principal cause of radiation related cancers. The records of DOE are particularly poor in this regard,

Long-Term Problems

Little attention was paid to the problem of long-term waste management when the plant was designed. In the early years, it was simply assumed, without significant geologic or other systematic scientific investigation, that the wastes could be safely pumped into the bedrock underneath the plant site, and below the much used Tuscaloosa aquifer. Pending such long term disposal, it was decided to store the wastes in carbon-steel tanks which were much cheaper than stainless steel tanks. However , this required the neutralization of the highly acidic wastes discharged from the SRP reprocessing plants, so that the acid would not corrode the carbon-steel. This created a much larger volume of waste, including sludge which is difficult to handle.

Eight of the first sixteen tanks developed leaks in the primary containment in about a decade. This has required much more handling and moving of the wastes than planned - which in turn causes more equipment and process problems, worker exposures and environmental contamination.

The plan to dispose of the wastes into the bedrock under the plant has been abandoned in favor of solidifying the wastes by encapsulating them in glass. Solidification of the liquid wastes is urgently needed.

However, the current glassification plans, which arc being implemented, also face some serious problems.

The operating record does not bode well for the proposed waste vitrification facility at SRP called the Defense Waste Processing Facility. This will require much waste movement and remote operation. If heavy maintenance and repair arc required, worker exposures may increase. Further, there is no operating experience even at the pilot plant level for vitrification of radioactive sludge, which has been the source of considerable handling problems. Unanticipated breakdowns or failure of the plant to operate as predicted could result in costly delays in the implementation of long-term waste management, while at the same time-leaving the wastes in the current dangerous liquid form.

DOE also plans to dump very large quantities of "low level" wastes, solidified in concrete, as part of its program. This will increase the radioactivity in the low-level burial grounds many fold. It almost certainly will contaminate the groundwater with very much larger quantities of radionuclides than are already present.
In particular, it will increase plutonium-238 contamination by about 100 *times,* and that by iodine-129 and technicium-99 by *several*

million times over the amounts that have been discharged already as "low-level" wastes into the seepage basins.

Some General Recommendations

o The Department of Energy should not be allowed to continue to regulate itself or its contractors.

o Current legal limits on DOE liabilities should be lifted. Further, DOE contractors should be held financially accountable for major accidents stemming from their negligence. Both would be great incentives for safety.

o Independent studies on various aspects of the plant such as health and safety, decommissioning and long-term disposition of the site should be initiated. All documents relating to these matters should be made public.

o The Savannah River Plant should be barred from producing any more high-level liquid radioactive waste until the long-term questions are satisfactorily resolved.

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Nuclear Seas

There are approximately 900 nuclear reactors in the world, with 374 in operation on land and over 500 at sea, powering USA, UK, French Soviet Chinese, and now Indian vessels. Reactors at sea operate without any regulations covering radioactive discharges or accident reporting. They are a continuous, moving source of radioactive pollution, and frequently break international law by travelling submerged within territorial waters of other countries.

The 500+ reactors at sea frequently operate in hazardous conditions and have regularly run aground, sunk, suffered fires, floods, mechanical breakdowns, and have collided with fishing boats, tankers and other warships. In the past ten years there have been over 200 accidents with Soviet subs alone, including the sinking of 3 subs complete with reactors and warheads. Two US subs have also sunk, and between 1965 and 1985 the US navy has had 628 "incidents" and two "accidents" involving nuclear weapons. It is impossible to calculate the risk of a major nuclear accident at sea because of the secrecy surrounding their operation and records.

Ireland is in the frontline of much nuclear activity with the Irish sea containig up to 15% of the US nuclear arsenal at any time and Warsaw Pact vessels on surveillance at either end. Both NATO and Warsaw Pact nuclear submarines travel underwater within Ireland's three mile limit, staying within the warm coastal waters to avoid infra-red detection by satellite. Nuclear subs can also carry up to 160 nuclear warheads. Thus these vessels not only pose a threat in themselves but they are also a target in the event of war and have the capacity to initiate a nuclear war.

Since the oceans are an essential part of life and provide protein for much of the world's population, it is imperative that the non-nuclear communities of the world unite against the continuation of the unacceptable contamination and threat to the seas. Earth watch, Irish CND, and Greenpeace-UK have plans to step up the campaign to denuclearise the Irish Sea, as part of the recently launched Greenpeace International campaign to Disarm the Seas.

Editors Note : This ought to be read in conjunction with newsreports about India's acquisition on lease of a Soviet nuclear powered submarine which would give the Indian Navy 'deep strike' capability. Those newsreports should be read together with other newsreports about India's sudden 'desire' to buy two nuclear power plants from the Russians and giving the go-bye to the much flaunted self reliance in the nuclear field.

Nevada Wins the Booby Prize

Thirty years of debate and uncertainty have been brought to an abrupt end by a sudden decision by the U.S. congress to name Yucca Mountain, Nevada as the site of the United States first repository for high level nuclear waste. The decision throws out the scientific site selection process laid out in the 1982 Nuclear Waste Disposal Act.

The 'honour' of being the site of the repository for high level-waste had originally been conferred on an abandoned salt mine in Lyons. The project was, however, cancelled in 1972 after two severe technical problems had become apparent. The area in which the proposed site was to be located was literally riddled with drill holes and cavities from numerous previous mining activities. If all the holes could not be detected and sealed -which was likely- the long term integrity of the site could not be guaranteed. The other discovery was of small pockets of brine in the salt. It was found that brine migrated towards the emplaced source of heat (the simulated waste) and corroded the metal canisters.

The congressional decision was greeted by howls of fury in Nevada. Governer Bryan attacked the decision as a "legislative atrocity" that "blatantly rejects the law of the land" and promised a "nuclear nightmare for the congress." The state will fight in the courts and through "whatever other avenues needed."

The selection process abandoned in the now legislation would have required the preparation of a short-list of *6* sites - 3 each west and cast of Mississippi - and each stable enough to store radioactive waste for 10000 years. A site would then have been chosen first in the west-less population density but far from the waste producing reactor sites thus entailing longer transportation - and some years later in the relatively more crowded east. But the process proved unworkable, despite many years of debate. In May '87 the department of energy tried to take a short cut by announcing three sites in the west (among them Yucca Mountain) and giving up the search for sites in the east. But the resulting uproar from the west quickly lead to demands to restart the whole process. Given the level of opposition everywhere, it became apparent that it might take decades to complete the assesment of even three sites. Earlier this year there was a proposal that a 100 million-a-year incentive be paid to any state willing to open up the first high level nuclear waste dump. But no state was found mercenary enough to commit suicide.

Now Nevada seems saddled with the dump. The great advantage of Yucca Mountain, a 1500 foot high ridge of volcanic rock, is that it lies well above the water table. A shallow storage area, 1200 feet underground would seem to permit easy access while avoiding possible groundwater leaching of wastes. Yucca Mountain is in a corner of the Nevada nuclear test range and far from human habitation. But state geologists argue that the site lies near an active fault and that a major earthquake or volcanic eruption may split it open. More immediately, the local tourist industry would suffer as visitors start sharing roads with waste bearing trucks. All these fears would have to be addressed in the ensuing site investigation, and if they turn out to be well founded, then the whole process will have to begin again at a new site with a delay of many years.

That site selection is no easy matter is clear from recent tevelations concerning U.S.'s first permanent site for low level waste, near Carlsbad, New Mexico. 700 million dollars have alredy been spent on a vast network of tunnels and storage rooms burrowed 2000 feet into thick salt deposits. Back in 1957. salt deposits were considered as the best repositories since the very pretence of salt indicated that there had been no groundwater incursions. However in just thirty years attitudes have had a sea change and it is now felt that "the area was selected in haste."

Sources : Nature 330, 682 24/31 December 1967
R.Pohl's stricle, "Will at busy Put" ia "Nuclears POWER—Both Sides" by M Kakus and J. Tcainer.

Editor's Note : There is _evidence of continuous human habitation for 10000 years of the Nevada Test Sit*. Nuclear activities the world over seem to have a special attraction for lands of tribals-politicaly the weakest section of society._

Another Pyrrhic Victory

Pyrrhus, king of Epirus (318-272 B.C.) fought a war with the Romans in 280 B.C. on the bank of Siris at Heraclea and defeated them. But the victory was won at too great a cost. "Another such victory and we are lost", he is supposed to have reflected (Geddie 1966). Problems of nuclear waste disposal have brought us on the threshold of another Pyrrhic victory.

Radioactivity was discovered only in 1896 A.D. but existed prior to its discovery too. Around 1500A.D. miners in Saxony and Bohemia died, after working on pitchblend excavation for about 5-10 years, of what was merely called lung disease. It is now deduced that the concentration of Radon (222) and its radioactive daughter products was at 10 to 20 times what arc now considered safe working levels, and it was the cause of those deaths. (Morgan 1976a). But as radioactivity was then not formally discovered, these deaths could be attributed to ignorance and regretted. Decades after the lethal effects of radioactivity were known, 60 uranium miners died of lung carcinoma because they were required to work at high risk levels. "It needed a unilateral rectitudmous action on the part of one individual in direct opposition to three powerful agencies, which could not be suspected to be innocent, to reduce the maximum permissible exposure level (Morgan 1976a) to a value recommended by the International Commission of Radiological Protection." The death toll and the incidence of radiation-caused cancer have in the meanwhile followed an inexorable but a sad course (Morgan 1976a). The lesson obvioously is that there is a strong nuclear lobby and few deaths would not deter them to deviate from the disastrous direction they have opted for.

It was initially thought that the resiliency of the natural environment to absorb pollutants was large and could be depended upon to dispose the pollutants off. As a result, even in 1943, it was considered reasonable to discharge radioactive waste in the White Oak lake (Morgan 1976a). The policy was that of "dilution and dispersal" (Morgan 1976b). There was pressure to accept occupational tolerance level which was 3.6 x 10^7 times as high as what is now considered accetable, Even when that pressure was not succumbed to, the level was still 36000 times the current recommendations (Morgan 1976a).

The Reality

Some of the radionuclides that can adversely affect health are among others tritium, strontium-90, cesium-137 and the transuranics. Typical halflives are 12 yrs, 30 yrs, 30 yrs and 25,000 yrs for tritium, ccsium-137, strontium-90 and plutonium-239 respectively. That the waste containment should last for 20 half-lives is a widely accepted thumb rule (Karam 1976). This figure would come to 250 yrs, 600 yrs and 500,000 yrs for the four elements above. It is important to note that these periods span a large number of human generations and it is ludicrous for any one to premise responsible and accident proof containment of these dangerous materials. As the total quantitly of nuclear waste to be disposed off increases over years, the thumb rule of containment for 20 half-lives may have to be revised upwards.

The ill effects of the radionuclides include radiation caused cancers and genetic mutations. (Mills 1976). It is well-understood by experts that the damage done is cumulative and irreversible, and the threshold theory is untenable in the light of the experimental evidence. Morgan 1976a) also the sections of society that benefit from the nuclar power and the group that suffers the hazards could be totally different (Peele 1976). Therefore economic cost-benefit analysis is highly improper.

But the issues are normally obfuscated wilfully. The terms such as MPE or MPD (maximum permissible exposure or dose) suggest that below that level, there are 110 risles : at least a layman would thick so. Subjecting unsuspecting population to unwarranted hazards violates the ethical principle of 'informed consent' which the medical profession is supposed to follow. The whole population has now become guinea-pigs in an experiment which hat potentials of endangering life, human and otherwise, on this planet. It has even been suggested that nuclear power is incompatible with indefinite sustenance and perpetuation of life on earth in time (Gofman 1976)

The protagonists of nuclear power tend to be callous in this regard. There is even a case of a scientist, who researched on carcinogenic toxicity of plutonium and voiced concern, being removed from job by a prestigious laboratory (Gofman 1976). Thus there is a deliberate attempt to deemphasize the problems. Secondly, there is a naive belief that safety procedures could take care of the problem. The fact, that human record *of* following any procedure scrupulously over long periods is dismal, is discounted. Recently, there was a report (Bhatia 1986) about radioactive parcels lying unattended with the other cargo at Delhi airport for more than 3 weeks, in direct and gross contravention of the pious rules.

In-plant retention of the hazardous material (Oakley and Logsdon 1976) which has been considered, must be ruled out as a solution due to the certainty of evertual human negligence or what can be cupomistically called act of God.

Discharge of nuclear waste in large water bodies, such as lakes and seas is dangerous. It was based on the presumption that the density of the pollutants would get diluted due to convection. This is a blind physical view. There arc many living organismns 111 the wattr bodies. Among them, autotrophic organisms absorb, requisite chemical elements for their sustenance directly from inar imate environment. Heterotrophic organisms live on nourishment they get from other organisms. Autotrophic organisms and an hierarcly of heterotrophic organisms comprise food chains or trophic chains (Lapo 1982) through which elements can be concentrated. Concentration of manganese, iron, vanadium and silver in some microorganisms can be by factors of 1.2 x 10^6, 6.5 x 10^5, 4.2 x 10^1 and 2.4 x 10^5 respectively (Lapo 1982). It is known that all the elements in periodic table can be used as constituents of living matter, and hence can be concentrated by living organisms. Acantharia use strontium to build their skeleton. Some plants also concenttrace various elements. In fact, the vegetation cover on the earth every year concentrates mineral matter in quantities that can be compared to those of most of the elements in lithospheric reserves, which have taken a geological time for accumulation (Lapo 1982). Not just the single species but whole ecosystems may be involved in concentration of elements. Many nitrogen-containing substances are eventually excreted by the animals. Many other elements after food-chain transport may be concentrated in the excreta of the animals. Uranium is one such element. On the sea coast of Peru the guano has uranium content higher by a factor of 10^4 ascomparcd to the sea water (Lapo 1982).

Apart from concentration of elements through food chains, living matter also performs vertical transport of matter against gravity (Lapo 1982) so that nothing can be assumed to be safely deposited at the bottom of the water bodies permanently and forgotten. The consequences of this role of the organisms arc very dramatic. DDT and radio-nuclides arc found ubiquitously in the tissues of organisms. Even the Antarctic penguins have not missed these in spite of neither DDT nor nuclear power being introduced there and the penguins being fightless. This is because trophic chains engulf the whole worlds' food supply (Willard 1976). Thus radionuclides have already polluted all the food chains. View this in conjunction with the fact that due to his omnivorous character, most, if not all, food chains converge in man, and the true ghastly nature of nuclear pollution of water bodies or for that matter, any corner of the biosphere, would be obvious.

How Many Grains of Salt ?

The present strategy of nuclear waste disposal *is* 'concentration and confinement' (Morgan 1976b). The Atomic Energy Commission (US) report in 1972 stipulates that the high-level radioactive waste be solidified and transferred to a repository owned by the government Karam 1970). A repository is supposed to be completely isolated from the biosphere so that the pollutants cannot percolate into any food chain. Further it is supposed to be a permanent storage facility, so that once the pollutants are deposited there, no more surveillance should be needed. According to one estimate soon about 1000 acres of land per year would be needed to bury radioactive polhartants (Karam 1976).

It was propoded in 1971 by the Committee on Atomic Energy (US) that the radioactive waste be buried in salt mines near Lyon, Kansas. The Atomic Energy Commission was to buy 200 acres of exhausted salt mines plus 800 acres of adjacent salt formations. Thus the scale of the problem is utterly underestimated. AEC regarded salt to be the *most economical encasement* for nuclear waste. It believed that as the temperature rises due to radioactivity, the salt would melt and fill the existing and prospective cracks in the surrounding rocks, providing good isolation. But the U. S. Geological Survey has criticized these conclusions (Hicks 1975). They have argued that all the boreholes in that area cannot be satisfactorily plugged, that subsurface water has been leaking, into the salt formations in that area, that the AEC model considered rock sections to be compounded of sand and shale as against laminated salt and shale which is the actual structure, that the compound effect of subsidence, heat flow, thermal expansion, etc, could break the seal of rock above, facilitating the surface and subsurface water to leak (Hicks 1975).

Number of inferences can be drawn from this controversy. (Firstly, the proponents of nuclear power arc committed to claiming that waste disposal is no problem. They will not tell us that a 1000 megawatt reactor produces more radioactive strontium, cesium and iodine than all the nuclear bomb tests conducted so far, or that the radionuclides generated during the production of one Kilowatt of nuclear power have the potential to kill 2,000,000 persons (Hicks 1975). They would rather tell us that our share of nuclear pollutants could be merely a fraction of a teaspoon (Gofman 1976) or that there are 500,000 square miles of salt in the U.S. alone (Riordan 1981) as if storing radioactive waste is the only utility of salt deposits.

Secondly, they are worshippers of economism. They would seek not a safe, but an economical solution to the problem of waste disposal. They would conduct an 'objective* cost benefit analysis to prove their point. Lost human life is merely so much monetary cost for them. Thirdly, they would not hesitate to suppress or falsify facts (Riordan 1981). "A half-truth is like a half-brick - it travels further", could be their motto (Mark Twain quoted in Hicks 1975). Fourthly, they have a limited temporal vision. If they can obfuscate issues over their life-time, they would be happy. 'Trusteeship of future generations' etc, arc not the notions that can appeal to them. That plutonium-239 has to be stored safely for 500,000 yrs is not an unsettling fact for them. Fifthly, in the present political set-up they arc allied with the rulers, so that no amount of popular resentment can really come in their way. Russell (1931) has written that Leonardo and Archimedes were permitted "to add to human knowledge on condition that (they) subtracted from human life". One wonders whether the governments and the nuclear protagonists have some such understanding !

Conclusion

Nuclear power is a fait accompli. The solution to the problem of nuclear waste disposal discussed in the section above should be thoroughly criticized from the geophysical viewpoint taking into account all the aspects such as thermal considerations, subsidence, tectonism, seismicity, volcanism, ground water flow, etc. Exploration geophysics deals with discovering minerals and structures conducive to the accumulation of minerals so that they can be mined. In the present context, it should study the structures where lethal pollutants can be hidden and isolated for long periods of the order of 500,000 yrs and judge whether proposed structures are, in fact, appropriate for the purpose. It may be remembered here that a committee with geologists, hydrologists, mining and petroleum engineers constituted by the National Academy of Science (US) had recommended that no waste disposal practice should be initiated merely because it is safe today unless it is guaranteed to be safe in future also when the waste production would be significantly larger (Hicks 1975).

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The Fission Connection

Recent events in W. Germany have confirmed the worst fears of antinuclear groups regarding safe handling of wastes. A bribery scandal linked to the illegal shipment and storage of nuclear waste has dealt a severe blow to the image of the nuclear power industry.

The scandal came to light in early December '87 when bribery charges were brought against employees of the nuclear waste transport firm Transnuklear, located in the city of Han au. One of the employees commtted suicide in prison after admitting his guilt. On 17th December it was revealed that Transnuklear had shipped more than 350 barrels of radioactive waste under false labels to temporary storage sites in W. Germany. The waste was intended to be processed in a Belgian reprocessing plant at Mol, and returned.

Mislabelled barrels besan turning all over the country and the numbers grew day after day, throughout the Christmas holidays. More than 1900 barrels were found and it was discovered that 321 barrels were contaminated with traces of plutonium and cobalt-60. Prosecutors are investigating why and to whom millions of marks bribes were paid by Transnuklear.

The next episode in this saga was of reports that bomb-grade fissionable material both plutnium and enriched uranium had been smuggled from W. Germany and Belgium to Pakistan and Libya. One report also talked of Britain and Holland being in on the deal which had allowed Pakistan to acquire 45 kg. of enriched uranium.

All these facilities in W. Germany and Belgium arc under fullscope safeguards. This means that they are under continuous inspection by inspectors of the International Atomic Energy Agency (IAEA) and the European agency (Euratom). The main objective of the inspections is precisely to prevent diversion of fissonable material to 'other' uses from nuclear facilities.

The latest in this continuing drama were allegations in the German magazine *Der Spiegel* that IAEA had great trouble in monitoring significant quantities of nuclear material. These allegations were based on an internal report prepared by the IAEA itself. The magazine said that in March 1986, the IAEA did not know the whereabouts of 188 significant quantities (SQ) of Fissionable Material which were to nave been transported from one nuclear facility to another. One SQ is the amount needed to build one atomic bomb.

The IAEA director Or Hans Blix has ordered a departmental inquiry into W. German nuclear industry's possible vioations of safeguard procedures.

Glasnost in the DAE ?

A few weeks ago, the department of atomic energy (DAE) did something unusual. It actually agreed to allow its senior officials to participate in a public debate which included a few critics of the country's atomic energy programme.

Five top officials—including the DAE secretary and chairman of the Atomic Energy Commission (AEC), Dr M.R. Srinivasan, and the director of the Bhabha Atomic Research Centre (BARC), Dr. P.K. Iyengar—took part in a panel discussion on "Issues in Nuclear Technology" organised by the BARC Officers' Association in Trombay. Ranged against these scientocrats were five "outsiders" with unequal access to information but with arguments at least as strong as theirs. They included Ivan Fera of *The Illustrated Weekly,* Amalendu Dasgupta, formerly of *The Statesman,* G.S. Bhargava, formerly of *The Indian Express*, Dr Dhirendra Sharma of the Jawaharlal Nehru University and myself.

The debate, structured with a bias in favour of the DAE officials, ranged, over four hours and a number of questions, from safety of nuclear energy, weaknesses in the management of the Indian programme, the nature of nuclear decision-making, the adverse economics of atomic erergy, the inappropriateness and limitations of nuclear power in the Indian context, and alternative sources of energy and their future.

It would not be an exaggeration to say that critics gave the worthies of the establishment a run for their money. The DAE was throughout on the defensive, although the discussion was organised in such a way that it was allotted much more time and nearly always had the last word on every issue.

The discussion also showed up many chinks in the DAE's armour, not excluding the ignorance of some of its officials about a number of issues : the energy scenario, the generic problems of nuclear, safety, the severe limitations of the perspective of "electrification" (centralised power generation and distribution) on which the case for nuclear power is founded, and the economics of atomic energy as well as renewable energy sources.

It also revealed that more than anything else, it is sheer faith, irrational faith, in nuclear fission as an ideal source of bulk electricity that underlies most DAE officials' case for ' atomic power.

Iyengar attempted a rather creative interpretation of the process of debate which showed up so many anomalies in the Indian nuclear programme. He announced that *glasnost* (openness) had been launched in the department—thus inadvertently admitting that all these years the DAE has remained closed, top-heavy and bureaucratic—a case that was, or course, ably argued by the critics.

The one-day discussion had several interesting features. It saw Srinivasan admitting publicly—for the first time that any AEC chairman has done so—that renewable energy sources do have a bright future and that nuclear power is *not* the sole future source of energy in a world where fossil fuels arc running out. This represents a marked improvement over the obnoxiously dogmatic and arrogant "nuclear energy only" positions adopted by AEC chairmen in the past.

Srinivasan also emerged as the ablest, indeed the only able, defender of the nuclear programme among DAE bigwigs, to the extent that the peogramme can be defended at all. Iyengar did not even address himself to the question and chose instead to glorify nuclear fission and the bomb as the "greatest scientific achievement" of mankind. He then proceeded to speak of the Madhava cult saints and the deep foundations of Indian scientific tradition !

A. K. De of the Atomic Energy Regulatory Board—that toothless safety agency which is subordinate to the AEC and does not even pretend to be independent of it-emerged as an uncritical supporter of the DAE. Ho had nothing to say about the "instructions" that the AERB is entitled to issue to the DAE in respect of safety' and its refusal to grant clearance to the latter's projects .and practices. With AERB as servile as it is to the DAE, remarked a panelist, the public can expect nothing from it.

S.L. Kati of the Nuclear Power Corporation asserted, without producing any evidence in support, that the DAE is capable of designing and building a 500 MW reactor. He then went to ask if solar cell-based electricity would not occupy too much space creating in effect a solar cell umbrella over our heads 1 (in fact, a one-watt cell occupies an area of only 1 cm^2; hence a 500 MW solar station will not occupy more than a fraction of the hundreds of hectares of land that the DAE takes over for even the smaller of its projects.) But that is another matter.

M.H. P. RAO, who has just retired from the Nuclear Power Board, conceded that the economics of nuclear power is partly a question of subjective choices and the values imputed to various components of costs.

The critics kept up their fire on several grounds : problems of decommissioning and waste storage (disposal being a virtual impossibility); the high costs of heavy water and of nuclear power; the failure of a centralised bulk power generating system to meet the real needs of the mass of the Indian population; the attractiveness of the alternative renewable energy sources and their safe environmentally benign nature; the weaknesses in the indigenous effort and the resulting dependence on foreign sources of design and supply; and, of course, the serious problems of nuclear safety at each stage of the so-called fuel cycle (better called fuel-spiral).

Compounding these are the disturbing features—callous neglect of safety, overexposure of employees to radiation and unconscionable secrecy—that characterise the Indian nuclear programme.

Srinivasan promised to be forthcoming with more information on "every aspect of the nuclear power programme" and to make public disclosures on many programmes hitherto considered to be out of the scope of public scrutiny. He stressed that he is as concerned as the public about safety, site selection and exposure limits and believes in sharing the necessary information.

However, when pressed to answer if he would agree to associating independent environmentalists, experts, health and safety specialists and other scientists, as well as members of the public liable to be affected by nucler projects, with the process of decision-making and review of site selection, emergency procedures, safety standards, etc., he maintained a studied silence.

Evidently, *glasnoss* does not go far enough in the DAE. But one can only hope that it will make some progress and that public scrutiny and evaluation of the department will be institutionalised so that the empire of the atom becomes accountable to the people so long as it exists.

Praful Bidivai

Praful Bidwal a journalist, has been for long a cri*tic* of the nuclear establishment. He is presently working as Assistant Editor, Times of India.

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NOTICE BOARD

ANN Newsletter : Anti Nuclear Network, an organisation based in Bombay was formed as a consequence of the visit of Dr. Helen Caldicott to India last year. They have brought out a newsletter -the first issue of which is a four page cyclostyled sheet. They intend to bring out six issues a year. The subscription price at Rs 25/year appears to be somewhat somewhat stiff but I suppose the same might be said of *Anumukti.*

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The scarcity of antinuclear material in Hindi has been a great weakness. Specially now that the rumblings of an antinuclear movement have begun at Narora, this weakness is all the more keenly felt. Dr. Dhirendra Sharma is writing a book in Hindi trying to fill this gap. The book will be about 150 pages in length and will be priced around Rs. 15. Commitments of prepublication sales would greatly help.

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An essay competition is being conducted by Philosophy & Social Action on the theme Nuclear Free World : Nuclear Power and Weapons. The last date for submission of essays to the organisers is 31st May 1988. There are awards of Rs 750, Rs 500 and two each of Rs 250 for essays judged best on grounds of original research, futuristic outlook and creative suggestions for restructuring a pose-nuclear social order.

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THE WINDSCALE ILL WIND

Politicians and scientocrats have always had a very cozy relationship. The shared vision of 'power' and 'progress' have enabled them to ride roughshod over the publics' right to know. The following story documents some of the facts of the Windscale fire of 1957 and shows how the facts were suppressed in the interest of promoting nuclear power.

A chilling picture of management incompetence is described in secret papers on the 1957 Windscale fire released by the British Public Record's Office.

The papers reveal there was no basic operating manual, that temperature gauges were in the wrong positions, and that the laboratory where milk samples were tested was out of action at a critical time.

The operators of Britain's first plant built in a hurry to make plutonium for nuclear bombs were close to panic as the fuel temperature rose to 1,300C. In an attempt to contain the damage, fuel channels were dislodged by what one senior manager described as "brute force".

These papers were released on 1. 1. '88 under the (British) rule which allows public access to government documents after 30 years.

But there is one significant omission among the hundreds of papers made available : the evidence of individual witnesses to the committee of inquiry into the fire has been withheld for a futher 20 years.

The Windscale fire remains the most serious nuclear accident in the West, worse than the meltdown at Three Mile Island in the US 20 years later.

Windscale was a military facility producing plutonium for the British nuclear tests of the 1950's. On 7th of October 1957, Pile no I was shut down for a routine fuel element change. However, certain physical processes resulted in an unexpected build up of heat which caused the cladding surrounding the uranium fuel to catch fire. This lead to the oxidation of uranium which in turn caused the graphite block containing the fuel elements to ignite, The ensuing fire raged for three days. The Windscale piles were cooled by air blown through fuel holes which was subsequently discharged into the atmosphere through two 125m chimneys. In spite of the fact that these chimneys were fitted with filters, a huge amount of radioactivity was released, spreading fallout over the UK, Ireland and much of western Europe.

Because of the military nature of the reactor, publicity about the fire and efforts to counteract the fall-out were kept to an absolute minimum. It was not until 13th October that local farmers were told that they would have to destroy milk, by which time the early phase of the radioactive cloud had passed over England.

A meeting of the top management at the Atomic Energy Authority agreed that the publication of a report on the disaster drawn up by the inquiry under Sir William Penney, "would severely shake public confidence in the authority's competence to undertake the tasks entrusted to them and would inevitably provide ammunition for all those who had doubts of one kind or another about the development and the future of nuclear power."

But it was not the authority which wanted to suppress the report, nor the chief scientist on defence, Sir Frederick Brundrett, who said there was "no security objection" to its publication.

Papers declassified show that it was the Prime minister, Harord Macmillan, who was determined to suppress the full damning picture.

Macmillan told his colleagues that the Penney report was "a highly technical document." He had come to the conclusion that "it would not be in the public interest to publish it."

Macmillan's real reasons were geopolitical and had nothing to do with public health and safety. He did not want to jeopardize U.S. transfer of nuclear technology to Britain and secondly he did not want to disclose details of military plutonium production at Windscale,

The fire burst cartridges containing uranium and possibly, it was said at the time, some containing lithium magnesium, material for the trigger mechanism of a nuclear bomb, The report by Lord Penney—the AEA number responsible for weapons research and development— recorded that "a major technical defect contributing to the accident was inadequacy of instrumentation for safe and proper operation. The absence of an operating manual must, it said, be regarded as "a serious defect". The brief instructions that were available were "clearly inadequate".

It was frequently necessary, the report said, for people in charge of the operation to climb 70 feet to the roof to inspect temperature gauges, which in the event were wrongly set. There was no lift.

There was "uncertainty" about who was responsable for making technical decisions and these were not comminicated to those who should have been told. "In our view," the connittee of inquiry said, "one of the lessons of the accident is that the Windscale organisation is not strong enough to carry the heavy responsibilities at present laid upon it."

It added on the health implications : "It appears to us untisfactory that tolerance levels in respect of several of the possible hazards should have had to be worked out in haste after the accident had happened."

Some of the these criticism were included in a white piper 01 the accident published on November '8 1957. But the white paper contained "reassuring paragraphs on public well-being," which were demanded by tord Mills, the minister of power.

In an annex attached to the white paper, the Medical Research Council said it was satisfied that *"it* is in the highest degree unlikely that any harm has been done to the health of anybody, whether a worker in the Windscale plant or a member of the general public. The secret reports, the papers released show, also reflect this assumption even though it was recognised publicly that no work had been done on calculating the effects of sudden short-term exposure to radioactive fall-out.

A report on the "Health physics aspects of the emergency", released, refers to "nigh contamination" on the early afternoon of October 10, 1957 ,the time of the start of the fire. By 2.30 pm, it says, a stack monitor reading, of 520 curies was recorded, compared to a normal reading of 10-20 curies.

One scientist at Windscale, Frank Leslie, the papers disclose, was unhappy about the handling of the accident. He wrote to the *Minchester Guardian* criticising the AEA for not warning people to remain indoors. Macmillan's response was, "Dr Leslie must be an opinionated ass."

30 years later, the pipers reveal Macmillan himself as both pig-headed and callous.

Sources : Richard Norton-Taylor in Sunday Mail (10.1/88)
WISE News Communique 282.2845.

HATCH REACTOR ACCIDENT

The Elwin Hitch nuclear power plant near Baxley, Goegia ha; experienced what has been discribed as the worst accident at a temporary facility for high-level radioactive waste in US commercial nuclear power history.

Approximately 141,000 gallons of radioactive water leaked out of storage pools, containing spent nuclear furl rois from the plant (levels of radioactivity are several times higher in the Hatch fuel pool than they are in the plant itself). An estimated 84,000 gallons passed through storm drains into a wetlands area located on plant property near the Altamla river. But .it has not been concluded how serious a health threat it may pose to the 50,000 inhabitants who live downstream.

The leak was discovered December 3, 1986. The radioactive waste continued flowing from the spent fuel storage pool for over eleven hours and water levels in the pool eventually dropped five feet. The accident occurred when several safety systems including the leak alarm system failed. This lead to a series of events earlier deemed highly unlikely, if not impossible, by the Nuclear Regulatory Commission (NRC). It also appears that operators had failed to repair a key safety valve they previously knew to be broken. This failure, along with other operator errors, caused the leak.

Source t WISE News Communique : 266.2237

Editors Note : Though this news is more than a year old, we are publishing it firstly slaces it did not make the Indian newspapers tad secondly because it provides an illustraction of the dangers posed to surrousdings by temporary storage of radioactive wants as nuclear plant sites as is also the practics in India.

Down's Syndrome: A Result Of The Windscale Accident ?

Research by Dr Patricia Sheehan, a specialist on Down's Syndrome from Dublin, Ireland, has Connected Down's Syndrome to radioactive contamination. Dr. Sheehan detected this relationship through a coincidence when, in 1974, a young mother with a Down's Syndrome baby came to her office. While the child was being examined, the young mother mentioned that babies with Down's Syndrome had also been born to some of her school friends.

Down's Syndrome, also known as Trisomy 21, is called after Langdon Pown, who over a hundred years ago first described the classical symptoms. Professor Lefebvre in Paris discovered that the disease is characterised by the presence of an extra chromosome. The cause of the extra chromosome is not fully understood It is considered that the age of the mother is important, as it occurs more frequently when the mother is over the age of 40 yean. Thus Dr. Sheehan felt the remark of the young mother was reason to make contact with other pupils of the school she had attended.

As it turned out, babies with Down's Syndrome were born to six out of the 213 women who had attended the school at the same time as Dr. Sheenan's client. The young women were then 12-18 years of age. Of this group, 53 were married when the study began in 1974. Of the 53. six of them were found to be infertile. The remaining 47 fertile women had a total of 142 pregnancies between them, resulting in 121 normal births, two neonatal deaths due to congenital heart disease, two cases of spina bifida (a genetic problem which causes babies to be born with cleavage of the some), three miscarriages, nine spontaneous abortions, one case of cystic fibrosis and the six cases of Down's Syndrome. Six cases of Down's Syndrome occurring in 142 pregnancies, is an incidence of one in 24 and is significantly higher than the accepted overall incidence of one in 600. This is unlikely to have occurred by chance.

The mothers lived in different areas, and the babies were all born at different times. The only thing the mothers bad in common was the fact that they had all attended boarding school together in Dundalk, on the east coast of the Republic of Ireland, during the school year 1957-1958. It was during this period, in October 1957, that the fire in the Windscale reprocessing plant occurred. Meteorological records show heavy rainfall during that period in. Dundalk. Also, in October of 1957, an outbreak of an illness, similar to influenza, occurred in the school.

When Dr. Sheehan began her study, she was looking for, a possible infective cause in the closed community of the boarding school. However, the possible connection with radioactity and with the Windscale accident could hardly be ignored in view of the coincidence in timing and the relevant information from the meteorological office's records.

This is not the only report of a connection between radioactive contamination and Down's Syndrome. Last year, the West German Institute for Human Genetics detected a significant increase of Down's Syndrome m children born in January 1987 in West Berlin. Researchers early on suspected a direct association with the Chernobyl accident as it had occurred in April of 1986, nine months prior to the increase in cases of Down's Syndrome. The study area was then extended to include the whole of West Germany. The author of the resulting report denied a connection, but in the view of other scientists who later examined the material, 'the significantly higher number of Trisomy 21 cases m children conceived shortly before Chernobyl bore out such a. connection.

Soures: WISE NC 284.2871. 14 December 1987

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ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Vol. 1 No. 5 **April 1988**

What does the father say then to his little girl when he hikes her up a certain hill ?
He says "Don't he afraid little dove.
Under this hill is buried an old atomic power plant, but it's perfectly safe."
And then, when the frightened little girl still doesn't want to climb it, what does he tell her ?
He says "But, really, it's quite all right.
Here, if you're frightened, give me your hand. Now give me your other hand. Now give the your other hand..."

Chernobyl: A Novel ***Frederik Pohl***

Two years ago this month a 'temple' of modern Russia blew its top. The radioactive poisons contained in it were spread far and wide. The air we breathe, the waters we drink, the land on which grows the food we eat all were affected. How many people died *i* How many more shall die in the future ? Experts have come up with numbers which differ from each other all the way from a few thousand to hundreds of thousands. The fall-out from Chernobyl was measured by a large number of independent observers and is not significantly disputed among experts. Then why are their estimates of the resulting malignancies so significantly different ?

Effects of large doses of radiation—like those suffered by people of Hiroshima and Nagasaki arc immediately apparent. Besides an early death, they include skin burns, cataracts, loss of hair, loss of apctite, nausea, vomiting and sterility. But what *of* those who live far from Chernobyl or live near normally running nuclear plants ? It is the unapparent and distant damage caused by low doses of radiation, which is a nutter of dispute.

The main cause of the dispute is the systematic campaign of disinformation carried out by promoters of nuclear power. People have been consistently told that cancer hazard from radiation exposure is smaller than it truly is. For decades the myth of a 'safe threshold dose'—below which radiation was harmless or even beneficial - was propagated. Today even that citadel of 'expertise', the International. Commission for Radiological Protection (ICRP) accepts that there is no safe dose of radiation. In fact al) the latest data have confirmed that the critics of nuclear industry have been right all along : radiation damage is cumulative and irreversible. Radiation is low doses is more harmful than previously believed. (Sec article "Radiating Complacency" in Anumukti vol. 1 number 3, Dec- '87)

Radiation like political rhetoric pays special attention to the weaker sections of the society. Sensitivity to radiation induced cancer is highest at youngest ages of exposure. "When a population of normally mixed ages is irradiated, about 73% Oi the cadiation induced cancers develop in people who were aged 20 years or younger at the time of exposure." (Goffman : Radiation and Human Health) The sick, the hungry and the very old are more prone to radiation harm than healthy adults. Women are twice as susceptible to radiation induced cancers as men.

Cheer-leaders for the nuclear industry have repeatedly claimed that many more people die from spontaneous cancers than shall die of Chernobyl cancer; in fact, that Chernobyl cancers will be undetectable. That is true. But undetectable is not the same as imaginary. Even a million real malignancies do not alter cancer statistics because a million is within the 'error bars'.

Information can be a deadly weapon. It is not only an 'act of Go a government made famine or an atomic bomb that can kill a million people. Disinformation which understates hazards does the task equally well. "In the USA alone 1½ million people per generation will get unnecessary cancer just from the unnecessary nigh doses used in medical diagnostic X-rays." (Goffman &: O' Conner : X-Rays : Health Effects of Common Exams)

It is a strange morality which finds it acceptable to kill other human beings so long is the victims remain faceless undetectables. The only antidote is a well informed citizenry which is not shy of resistance. Edmund Burke put it well long ago : "All that is necessary for the triumph *of* evil is that good men do nothing."

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Radiation Effects in Tahiti

'Throughout the Pacific we're now seeing the same diseases and conditions that occured at Hiroshima and Nagasaki. - stillbirths an*d* growth retardation," says Or. Tony Atkinson of the International Physicians for the Prevention of Nuclear War (IPPNW). Atkinson was speaking in relation to the over 225 Tahitiaus who had paid thousands of dollars to fly to New Zealand for cancer treatment rather than attend free hospitals with sophisticated equipment for cancer treatment run by the French military in Tahiti.

The Tahitiaus distrust the French military because they believe that their cancers are a result of the French nuclear testing at Mururoa. Until now there has been no way of conclusively proving this. Dr.Atkinson soon hopes to be able to begin a study in Tahiti aimed at analysing residents' teeth for Strontium-90-u known radionuclide.

In Tahiti's military run hospitals, patients with cancers suspected of being radiation induced have their files declared security documents This particularly applies to those who have serviced ships and planes on Mururoa. There's almost a total security blackout on the health of Tahitians. The health statistics are falsified and don't list everyone who dies, he says. Until 1980, when the World Health Organization intervened, French authorities in Tahiti did not even keep a cancer registry. There are still not statistics for thyroid cancer in Tahitian men - known result of radiation exposure after a bomb explosion.

French Polynesia has the highest number of cancer deaths in the Pacific. Cancers caused by radiation such as leukemia, for example, arc double what they arc in American Samoa on the other side of the Pacific.

Source : WISE News Communique : 286.2901

How Many Chernobyls ?

The Nuclear Power Industry Could Produce Three More Chernobyl-Sized Accidents by the Year 2000

Through April 25, 1986, the Chernobyl 4 nuclear reactor was one of the world's most reliable. It had the best operating record of any power reaction in the Soviet Union, producing at 83 percent of capacity in 1985. But on April 26th it exploded, hurling the contents *of i*ts radioactive core across Europe.

That such a seemingly reliable reactor should be the site of the world's worst nuclear power accident raises fundamental questions about the safety of nuclear power everywhere. Like Three Mile Island before it, Chernobyl reminded us that capturing the energy of the atom is, by its nature, a risky proposition. But how risky is it? How many Chernobyls might nudear power have in store for us ?

Long before Chernobyl, nuclear experts had agreed about the possibility of accidents killing people and irradiating large areas. Indeed, despite major design differences between the Chernobyl plant and those used in the West, che risk of a serious accident is one characteristic that all large nuclear reactors share.

The real argument is over the frequency of serious accidents. Defenders of the industry claim catastrophic accidents are extremely rare events. At the United States Atomic Energy Commission, precursor to the Nuclear Regulatory Commission (NRC), Dixie Lee Ray often argued that nuclear power was safer than eatng because more people had choked to death than had died from nuclear power.

Since the accident at Chernobyl, however, t seems inevitable that many people will die from nuclear power, and for the most part, the risk they have taken is an involuntary one.

The Calculus of Catastrophe

To calculate the odds of nuclear disaster, engineers developed a modeling tool in the early 1960s known as probabilistic risk asscssnaeut. Using this method, analysts study accident scenarios and failure probabilities of critical components, estimate safety margins, and develop overall estimates of risk.

Government-sponsored studies in the United States and West Germany have estimated that severe nuclear core-damaging accidents should occur once every 10,000 "reactor years." (A reactor year is a unit used in discussing experience in operating nuclear reactors. The world's current total of 366 operating nuclear power reactors chalked up 36ft reactor years in 1986, for example, regardless of how many days they were actually on line.)

Even if the one-in 10,000 figure, is correct, assuming that 500 nuclear plants are in operation by the late 1990s, there would he one core-damaging accident every 20 years. However, a post-Three Mile Island study by the Oak Ridge National laboratory in 1982 raised the risk to once in 4,000 reactor years or once every eight years.

Experience so far indicates that these otinntes are based on uncertain assumptions that often do not reflect actual plant conditions. For example, circuit breakers connected to crucial safety systems at the Salem nuclear plant in New Jersey were estimated to have a one in 33,000 chance of failing. Yet, two circuit breakers malfunctioned in one week. Only prompt action by an alert operator prevented a serious accident.

Redundant safety systems have also been simultaneously destroyed, supposedly a highly improbable event, leaving no margin for safety. The 1975 Browns Ferry fire in Alabama destroyed several redundant electrical systems, shutting down the control room and threatening catastrophe.

The limitations of probabilistic risk assessment as an accurate forecasting tool were detailed in a 1986 report by the Paris-based Nuclear Energy Agency, which concluded that they arc useful in evaluating the reliability of particular plant components but of uncertain validity when assessing overall safety.

So far nuclear power has been more accident-prone than predicted by the experts. Three Mile Island occurred after 1,500 reactor years, and Chernobyl after another 1,900 Core-damaging accidents arc occurring at over twice the rate predicted by the Oak Ridge study, casting doubt on the accuracy of these major probabilistic assessments.

Of course, not all core-damaging accidents result in major releases of radioactive material, at Three Mile Island the secondary containment vessel held virtually all the core material inside. On the other hand, much of the Chernobyl core was deposited on forests and farmland thousands of kilometers away.

With more nuclear power plants coming on line, especially in Europe, the chances and likely frequency of a serious accident arc increasing .is well. Assuming a continuation of the accident rate of one core-damaging accident every 1,900 reactor years, there would be three additional accidents by the year 2000.

At that point, with 500 reactors in operation, core-damaging accidents would occur every four years. Scientists *in* Sweden and West Germany have used this data to estimate a 70 percent probability that another such accident will occur in the next 5.4 years.

These figures are not a prediction of what will happen in the future, but rather an indication that the worldwide nuclear accident rate has already become unacceptable. The nuclear industry cannot, and perhaps should not, survive the public opposition that would be the unavoidable consequence of a continuation of this dismal history.

Blind Faith in Technology

When Pennsylvania's Governor Richard Thornburgh toured nuclear facilities in the Soviet Union in 1979, he was informed that nuclear safety was "a solved problem" and that it would soon be possible to safely operate a reactor in Red Square. Three Mile Island, he was told, had little relevance to the Soviet nuclear program.

Complacency and arrogance clearly helped sow the seeds of disaster in the Ukraine. The Chernobyl plant exploded when operators overrode multiple safety systems during a test. These actions, along with statements by Soviet officials, demonstrate that the Soviets had an almost blind faith in technology.

Ironically, the excellent performance of the Chernobyl plant may have bolstered this overconfidence, encouraging the operators' blatant violations of safety procedures.

The accidents at Chernobyl and Three Mile Island can be traced to human mistakes and, more specifically, to the "man-machine interface" at the center of complex technology.

The President's Confuession on the Accident at Three Mile Island stated in its 1979 report : "Equipment can and should be improved to add further safaty. to nuclear power plants-But as the evidence accumulated, it became clear that the fundamental problems are people-related problems and not equipment problems."

The conclusions of the official Soviet report on the Chernobyl disaster were similar : 'The prime cause of the accident was an extremely improtable combination of violations of instructions *in* operating rules committed by the staff of the unit.-The accident assumed catastrophic proportions ...... because all the negative aspects of the reactor design...were brought out by the operators."

The fact that operators helped cause both accidents means that plant control systems and operator-training programs need to be upgraded. It does not mean, however, that the solution is to replace human operators with robots. Computer systems can malfunction or be misprogranuned, and some aspects of plant operation require human judgment. As long as people run nuclear power plants, human error can never be entirely avoided.

Incidents in the United States demonstrate that carelessness and willful violation of operating procedures arc not confined to Soviet nuclear plants. Less than a year after Chernobyl, an engineer at the U.S. Nuclear Regulatory Commission detailed a longstanding pattern of operators turning off important safety systems unknowingly or through carelessness. Were problems to develop while these safety systems were turned off, then an otherwise manageable situation could have gone dangerously out of control.

Irresponsible operators are another problem. In April 1987, fourteen of twenty-six nuclear workers of the Tennessee Valley Authority, America's largest nuclear utility, tested positive for drug use. At other nuclear facilities, cheating on operator licensing exams has become "common.

Operators at the Peach Bottom plant in Pennsylvania were found sleeping in the control room with the reactor at full power in 1987. The NRC shut down the plant, and the owners promised to rectify the situation through a Voltery of measures, including replacing comfortable high-back chairs with low-back models.

A Dismal Record'

Despite post-Three Mile Island improvements, American nuclear plants arc still plagued by problems. There were almost 3,000 plant mishaps and 764 emergency shutdowns in 1985, up 28 percent from 1984.

The average nuclear plant in the U.S. was shut down six times in 1985, and the industry as a whole averaged two shutdowns for day. More than just a sign of trouble, emergency shutdowns are sudden, violent procedures that stress a nuclear plant's intricate and crucial plumbing, and can impair safety.

Although most of these shutdowns were due to minor problems, at least 18 were serious accidents that could have led to core damage.

One of nuclear power's fundamental problems is that even the most trivial incident could one day lead to catastrophe, a fact made possible by the enormous complexity of these systems. Significant nuclear incidents have already been initiated by hungry field mice, a worker's loose shirttail and an improperly used candle.

Intensified Congressional and regulatory scrutiny of the American nuclear power industry since the Chernobyl accident has apparently done little to improve the safety record. Indeed, a string *of incidents in* the year since the disaster show just how far from foolproof reactor safety systems are. The most consistent element in these incidents is human error combined with design flaws.

The nuclear power industry's flawed record since Chernobyl is not just a superpower problem. France, largely quiescent about the risks of nuclear power since the election of President Francois Mitterand in 1981, and now reliant on nuclear power for 70 percent of its electricity, was reawakened in April 1987 by two accidents.

At least 25 tons of potentially combustible sodium coolant leaked from the experimental Superphenix breeder reactor on the Rhone River for two weeks before the source could be identified. Next, the Tricastin uranium enrichment plant, also on the Rhone, suffered a leak of highly corrosive uranium hexaafluoride that injured seven workers.

Reports of incidents and controversies since Chernobyl have trickled in from other parts of the world as well, including Brazil, Mexico, South Africa, *Spain* and the United Kingdom. Because many countries do not report accidents at nuclear installations, and consider all nuclear issues to be state secrets, it is quite possible that the list of reported incidents remains incomplete.

Aging Nucear Plants

There are other problems on the safety horizon. The world now has a growing number of aging nuclear plants, many beginning to show signs of deterioration. In 1990 there will be 35 plants that are at least 25 years old; by 1995 there will be 66, and in 2000 there will be 150.

The nuclear industry has little experience with aging nuclear plants, but is about to get a crash course as many plants have already developed unanticipated problems. Among the most serious are corrosion of steam generators and embrittlement of steel pressure vessels due to neutron bombardment. Both of these problems are rampant in some types of plants; they involve critical components and arc difficult to remedy.

The problems of aging plants were highlighted in late 1986 when Virginia's 13-year-old Surry nuclear plant suffered a "guillotine break" in a hot water pipe. Four workers were killed by steam burns and the plant was closed for several months while the plumbing system was thoroughly inspected.

After the accident, inspectors found extensive corrosion of pipes in areas where decay had never been anticipated. A back-up valve that should have stopped the surge of scalding water had not been properly installed. In some places half-inch pipes had been eaten away to less than the thickness of a credit card.

This incident and others like it indicate that nuclear plants are aging in unexplained and dangerous ways, and that nuclear technology continues to present engineers with unwelcome surprises.

Aging U.S. military reactors may present more immediate hazards than their commercial counterparts, a point reinforced by their similarity in design to the Chernobyl reactor. After Chernobyl, the U.S. Department of Energy (DOE), which runs the military's nuclear programs, was forced to temporarily shut down all of the reactors and processing plants that produce plutonium for nuclear warheads.

Independent reviews showed that the plants were antiquated, poorly managed, largely unregulated and a danger to workers and the general public. Ironically, a Soviet nuclear accident may have saved the U.S. nuclear weapons industry from an embarrassing and lethal mishap.

The first facilities to be closed were two processing plants on the Hanford nuclear reservation, a vast expanse of desert bordering the Columbia River in eastern Washington state. On September 29, 1986, workers began a routine procedure of pumping plutonium, suspended in a liquid solution, from a separation facility to a storage tank in the plutonium finishing plant. Because a transfer line was not sealed, the plutonium was diverted to an already full storage tank.

Had enough of the new plutonium mixed into the full tank, plutonium concentrations could have approached "criticality", risking a nuclear chain reaction and releases of radiation. The Department of Energy ranked the incident as a four on a danger scale of five.

During the same month, the Government Accounting Office (GAO)of the U.S. Congress revealed that several of DOE's nuclear weapons production sites, including the Hanford reservation, were severely contaminated with both radioactive and toxic chemicals. In some places concentrations of the materials in soil and groundwater were hundreds or even thousands of times higher than safety guidelines.

Later, a scries of critical reviews led to the shutdown of the N-reactor at Han ford, the oldest of the nation's plutonium production reactors. The N-reactor *is* the U.S. reactor most similar to the Chernobyl design—it employs a graphite moderator and lacks a full secondary containment vessel.

According to official reports, the plant suffers from aging equipment, poor maintenance and staff complacency. A late 1987 report by the National Academy of Sciences concluded that the Hanford plant and others like it are at risk of a Chernobyl-like catastrophe.

The next wave of shutdowns came in March 1987 when the GAO told a Site committee that four plutonium-producing reactors at Savannah River in South Carolina had operated for most of *seven* years at power levels far beyond what the emergency core-cooling system could have handled in an accident.

GAO investigators went on to detail a pattern of poor management, inadequate external review, and disregard for safety and environmental protection. They characterized the Savannah complex as "costly, diverse, potentially dangerous and aging."

Pending Judgment

How many more Chernobyls ? It is impossible to answer this crucial question. Looking at the experience of the world's operating plants, though, suggests that additional accidents are likely in the next decade.

On the positive side, Chernobyl has increased many countries' stated commitment to nuclear safety, and led to some safety-specific action, such as the long overdue shutdown of plutonium reactors in the United States, and the creation of a cabinet-level position for nuclear safety in West Germany.

Whatever improvements in safety standards Chernobyl may have precipitated, they cannot stop the ultimate, double-fisted enemy of nuclear safety—time. Even if accidents occurred only once every 10,000 reactor years, and if the world's inventory of reactors did not grow beyond 500, core-damaging accidents would occur about five times per century.

Time also slowly wears away at the precise machinery that is central to nuclear technology. The inevitable aging and physical deterioration of the world's nuclear equipment could swamp efforts to make nuclear power safer

Technology, training, strict regulation and vigilant oversight can lower the chance of catastrophe But in the end, the chance remains.

Computer models can help us to understand the risks, but they cannot pass judegnment-they cannot tell us how safe is safe enough. The answer to that question will always fall to human beings.

In the immediate future, tighter regulation, improved management and the willingness to shut down dangerous plants are clearly in order. Over the long run, the merits of the atom must be weighed much more carefully against the alternatives. Ultimately it is the world's people, through their national political systems, who must decide how safe is safe enough.

Christopher Flavin, a senior researced at World-watch Institute in Washington, D.C.. *is author of Reassessing Nuclear Power: The Fallout from Chernobyl and coauthor of State of the World* 1987. *Courtsey : World. Watch Jan. Feb. 1988.*

GUJARAT PROTEST

The messing of the Gujarat Anu Urja Jagruti at Vadodara on 14th February, 1988' was significant in as much as it provided an opportunity for evaluation of the present position of the anti-nuclear movement in Gujarat and also a chance to chalk out some long range and short term programmes for the future.

Shri Chinu Shreenivasan's paper entitled "Where do we go ?" provided the basis for critical review and assessment, It was felt that lack of continuity in the movement was a major weakness. It was also felt that not many people give much time to it in spite of their deep interest in the issue. Stress was laid on strengthening the movement both at the grassroots and the state levels. Giving his ideas about the future course of the movement Shri Babubhai J.Patel, ex-Chief Minister, suggested that the information that we have at present should be widely diffused in the public. He also emphasised the need for a dialogue with the state and central ministries. Dr. B.G. Desai, a consultant on energy, pointed out that nuclear policy was after all only a small part of our over all energy policy, which was going astray.

It was decided that educational and organisational activities should be continuously going on in the Kakrapar and Surat areas. The ideas of organising local committees and training camps for local leaders were mooted. It was also decided that some of the larger towns of the area should be covered intensively in the programme of Anu Urja Jagruti.

The following programmes were chalked out for the state level ;

1. To prepare a small pamphlet on the issue and to send it to all the representatives of the State Legislative Assembly and members of the Parliament from the state.
2. To discuss the issue with members of the Assembly.
3. To try to prepare some members to raise the issue in the Assembly.
4. To organise a march on wheels from Kakrapar to Gandhinagar ending on the Chernobyl Day (26th April).
5. To seek an interview with the Chief Minister after the march, and to convey the message of Anu Urja Jagruti to the Prime Minister through him.

Committees were appointed to :

a. Draw a detailed programme for the suggested march on wheels,
b. To collect the money needed for such a march,
c. To find out the possibilities of asking for a legal stay on the construction of the plants.

Editor Bhoomiputra promised to give the nuclear issue much more space in the future numbers.

Editor Anumukti announced that those interested in selling retail copies of Anumukti will be given special commission ou bulk orders.

A small exhibition of charts and paintings was also displayed at the meeting. It was decided to display that exhibition along with film and slide shows during the Kakrapar Gandhinagar march too.

One Deadly Summer

Something strange happened to America in. the summer of 1986 : around 35000-40000 more people than usual dropped dead. A statistical fluke ? Dr.Jay Gould, a fellow of the Institute of policy Studies in Washington and a distinguished statistician, thinks not.

The seasonal pattern of mortality in America is pretty stable. Over the 80 years before 1986, 31.7% of each years deaths occured on average during the four summer months *of* May to August. In 1986 that percentage rose to 33.1% the highest this century and 1.1 percentage points above the 1983-1985 average of 32%. Dr. Gould calculates that the odds of such an increase happening by chance are more than one million to one. So what happened ?

The explosion of a nuclear reactor at Chernobyl in Russia on April 26th, 1986 and, in particular, the ensuing radioactive plume that reached America eleven days later, may offer a clue. When the radioactivity arrived, rainwater samples in northwestern regions of America recorded 46 picocuries (pC) of radioactivity per litre. By May 12th,' in the northwestern state of Washington, the level had risen to 6620 pC per litre. In milk samples—a routine indicator of radioactivity—the concentration of radioactive Iodinc-131 peaked at around 130 pC per litre, compared with che 1985 average of below 7pC per litre. Because the 130 pC per litre peak was less than 1% of the American government's coaling of 15000 pC per litre for milk radioactivity, no action was taken. The levels were after all, between 100 and 1000 times lower than those recorded across Europe after the disaster.

Dr. Goulds analysis picks up a worrying correlation between regional American levels of radioactivity in milk and regional mortality in the summer of 1986. For several reasons - such as rainfall patterns and the precise path of the radioactive cloud - levels of radioactivity varied sharply across America. Dr. Gould calculated averages of peak concentration of Iodinc-131 in milk for each of the census bureau's nine regions during the four month period. The highest concentrations were seen in Pacific northwestern states such as Washington and California. In those states the total number of deaths in four months was 5% higher than it had been in May-August 1985. In areas recording the lowest concentrations - such as the central southern states of Texas and Arizona - the number of deaths was unchanged from the previous summer. That relationship between radioactivity and death held true throughout the country. Statisticians have tests to determine how likely it is that such correlations are blue to mere chance. The tests showed that for these correlations, sheer coincidence was hardly possible.

A Radical Theory

According to received wisdom, exposure to such low levels of fall-out is harmless. Some people even claim that a little radiation is good for you. Most of the debate *on* the medical consequences of Chernobyl has centred on the long term dangers of cancers and genetic defects in future, generations that can be caused by higher doses. Any suggestion that the disaster had immediate adverse effect on mortality rates is heresy. Recently the OECD's Nuclear Energy Agency reaffirmed its belief that the risk of "radiation related harm" to the public in western countries had "not been changed to any noticeable extent" by Chernobyl.

Such claims ignore research into indirect effects of low level radiation according to Dr. Earnest Sternglass, emeritous professor of radiological physics at the University of Pittsburgh. Instantaneous bursts of high level radiation - such as medical X-rays - are relatively harmless to normal adults. That is mainly because such "external" radiation does not concentrate itself in crucial organs. Ingested or inhaled fission products behave rather differently. Once inside the body, they seek out various organs according to their chemical characteristics. Iodinc-131 heads for the thyroid, Strontium-90 and Barium-140 (which chemically resemble Calcium) head for the bone marrow. Then they sit there emitting radiation.

Such low level radiation promotes the slow release of molecules known as free radicals. The most common - Oxygen free radical - arc also a by-product of normal oxygen using reactions. But their production is increased by protracted exposure to radioactivity of ingested fission products.

Oxygen free radicals are unstable oxygen molecules with an extra electron. They arc attracted to the membranes of the cells, which then they damage, disabling the cell. This process is efficient only when there is a low concentration of free radicals. At high concentrations (that is at high radiation doses) the free radicals deactivate each other. That is why America despite its lower close of radiation, the have suffered more from this problem than* parts of Europe.

How could Americas increased mortality rate in the summer of *1986* be related to the damage colsed by free radicals ? Among the celt functions impaired or destroyed by prolonged exposure to free radicals is the production of hormones and various types white cell which provide the body's immune defences. Such an erosion of the immune system might be expected to hit two groups of people first : the old or weak, and those suffering from life threatening diseases.

Of all those Americans aged over. 65 who died in 1986, 32.7% did so in the four summer months. During the same months in .1985, the proportion was only 30.6% This suggests that in 1986 something was hastening their demise. Compared with the summer average *of* 1983-1985, an estimated 7.4% more people died iu summer of 1986 - around 30000 people.

The number of people dying from nncumonia in all age groups was 18.1% higher in May-August 1986 than in the same months of 1985. Deaths from infectious deseases rose by 22.5%, over the same period. And deaths caused by AIDS and its related infections increased by 60.3%. As the table below shows, the year on year changes were much smaller in the first four months (January to April) *of* 1986. And they fell back during the final four months of the year.

American Mortality 1986

No. of deaths from :	Jan-Apr	May-Aug	Sep-Dec
	% change on a year ago		
Pneumonia	-5.7	+18.1	-34
All infectious diseases	+2.3	+22.5	+15.7
AIDS related infections	+ 11.6		+ 19.8

Leaving out deaths caused by accidents, suicides, drug abuse and violence. Dr. Gould found that the natural death rate of all people aged between 25 an*d* 34 was 5.3% higher in 1986 than in 1985. That age group was born in the 1950's, a decade when atmospheric nuclear bomb testing was at its peak. As the}' have aged the mortality rate of the age group has increased much faster than the mortality rate of those born between 1935 and 1944 - before bomb testing started. Doctors believe that fall out from testing may have weakened the immune systems of the very young. In later life that might make them more susceptible to the biological effects of additional fall-out.

Americas seasonally adjusted fertility rate - measured by number of live births per 1000 women aged between 15 and 44 - fell to a record low during July and August 1986. In contrast, live births rose in the first four months of 1986. The fall is due, Dr.Sternglass believes to an increase in miscarriages, foctal deaths and still-births. During the summer infant mortality rates reflected the regional pattern of milk radioactivity.

Both Dr.Gould and Dr.Sternglass emphasize that their work is still in its infancy. But their analysis already suggests that the change in the American way of death in 1986 was not a nutter of chance. If Chernobyl was the cause, a complete review of "safe" radiation levels is needed. And if Chernobyl was not to blame, what was ?

Courtesy : Economist : *Jan* 30-Feb 6 1988.

Editors Note : India suffered similar low level fall out as USA The numbers of the very young, the sick and the malnourished are much larger in India. Unfortunately our mortality statistics arc not good enough to detect this effect.

Utterly Gutterly Butter

The Supreme Court of India by an order of March 8th, 1988 dismissed the special leave petition brought by Dr. S. S. Wagle and others against the Union of India. The petition challenged the marketing of 3000 tons of butter imported from Ireland by the National Dairy Development Board. (NDDB)

For the last two decades we have been in the throes of a flood. Described sclf-promotionally as the "White Revolution" it was designed to nuke India awash with milk. Today rivers of milk do flow through most parts of urban India. Unfortunately, the design envisaged the rivers to originate in the butter mountains of the European Economic Community. (EEC).

The explosion at Chernobyl cast a shadow on this scheme. Large parts of Europe were contaminated by the fall-out. The EEC governments themselves were quick to ban import of food items from eastern Europe even from places a thousand kilometres distant from Chernobyl. Radioactivity respects no frontiers. Significant radioactive fall-out was deposited also on western Europe. The long lasting radionuclides like cesium-137 (half life 30 years) have got incorporated into the soil. From there to grass, cows, milk, humans and back to soil is a simple cycle. The process will go on and on.

The accident initiated an acrimonious debate within the EEC with regard to 'acceptable' limits for radioactive food contamination. The nuclear lobby wanted to raise the existing limits. They demonstrated their clout when the EEC council of ministers on December 14th, 1987 did raise the limits by a substancial amount. This was despite an earlier vote in the European parliament which had recommended ten times lower doses. The major point to note is that 'acceptable' is not the same as safe. There is no safe limit for radiation. This has been accepted by some W.German courts and they have upheld the appeal of a woman who wanted to return milk powder less contaminated than the government approved 'safe' limits.

In the meantime, the food multinationals were busy exporting contaminated produce to the third world. Singapore, which probably has the most efficient system of testing and control, rejected 240 separate consignments of contaminated food just upto October '86. A large number of other third world nations including Sri Lanka, Bangladesh, Malaysia, Philipines and Guyana have rejected milk products from EEC. Some W. German activists last year resorted to direct action by breaking into a train filled with contaminated milk powder and destroying a large-number of sacks meant for the third wo;

India being the largest dump-ground of EEC milk products one would have expected the Indian government to have taken vigourous action to protect the population from this additional menace. Instead, the reality has been very far from this. The burden of protecting public health has been taken up by public spirited individuals like Dr. Wagle *and* others.

Between April T986 and September 1987, commodities imported from the EEC were released on the basis of "certificates of fitness" provided by the suppliers and the Union agricultural ministry. BARC turned a blind eye to alarming reports coming from various third world countries. That these commodities were used throughout the country in milk and also in infant foods appears to be pretty certain.

Wagle's battle began in late 86. Beginning first by cautioning the government not to release the butter, the Maharashtra State Government Employees Confederation spearheaded by Wagle got a recalcitrant NDDB and the Greater Bombay Milk Scheme (GBMS) to undergo tests to determine radionuclide contamination by BARC. But the widely different results of the test, coupled with enormous flaws in collecting samples for the tests and the determination of the state government to go ahead with marketing the butter forced Wagle to move the Bombay High Court. After granting a stay order initially, the petition was dismissed and the matter brought before the Supreme Court.

The main arguments put forth in the petition were the following :

1. "Permbsible levels" implied an accep-

table level *of* risk including the risk of death.

2. Maximum limits are normally expressed in the terms of annual intake for a statistically "standard" man: they are not adjusted for specially vulnerable sections like pregnant women, children and malnourished infants.
3. The "permissible levels were based on an extrapolation from the Hiroshima and Nagasaki data to low doses on ? linear basis. This procedure was seriously flawed asecepted even by the ICRP.
4. NDDB by not labeling the origin of it's products was denying people the right to decide for themselves whether or not to or contaminated food.

Amongst other testimony the petitioners also produced a letter from George Wald, Nobel Laurate and Professor of Biology at Harvard University, parts of which are reproduced below :

"In reality no threshold exists for damaging effects of ionizing radiation or radioactive material ingested or respired. Any level may result in some damage, more does more damage. From that viewpoint, every dose is an overdose.

So-called "permissible levels" of exposure are compromises with convenience, economic pressures, business interests and political expediency, superimposed on a consideration for health. Ideally all such exposure should be avoided. The presence of unavoidable background radiation, perhaps even larger than is offered by some new source, is no excuse for accepting the added threat of the new source.

For persons suffering from hunger it makes a gruesome choice to offer to relieve the hunger at the expense of the threat of eventual malignancies. I can imagine situations in which that ghastly choice might need to be made; but then in full awareness of the risks, and keeping the radioactive exposure to the absolute minimum. The threat is greatest to infants and the young, falling off with age."

The Supreme Court's position is best expressed in its own words : "Having regard to the magnitude, complexity and technical nature of the enquiry involved in the matter and keeping in view the far -reaching implications, we must at the outset clearly indicate that a judicial proceeding of the nature initiated is not an appropriate one for determination of such nutters."

Therefore the court appointed a committee of three experts and decided to follow their advice. The experts were : Dr.M.G.K.Menon-member Planning Commissi, Dr.P.K. Iyengar, chairman of BARC and Mr.G.V. K.Kao, vice chairman, Karnataka Economic Planning Council. Of the three, the first two are representatives of the atomic energy establishment and the third a long term supporter of NDDB. The experts commence reached it's predictable conclusion :

1. "The permissible levels *of* radioactivity in milk, dairy and other f*ood* products fixed by the Atomic Energy Regulatory Board as per it's communication of August 27, 1987 have been arrived ar after due consideration of ICRP dose limits for the general population.
2. The AERB has allowed more safety margin than other countries, and international organisations like EAO and WHO, in arriving at the levels fixed for milk, dairy and other food products. The levels adopted by AERB are one of the lowest in the world.
3. The consumption of milk, dairy and other food products, having levels of man-made radionuclides below the permissible levels fixed by AERB, by all sections of population, and throughout the year, are safe and harmless."

Having taken the attitude that the issue was too technical and complex and hence having decided to rely on expert judgement, the court had left itself with no other alternative but to dismiss the petition. The judgement raises an important issue. It is an individuals right to decide what risk he or she wants to take. The exercise of the right cannot be denied under the pretext that in our daily lives we take similar or greater other risks. By not forcing the NDDB to properly label the origin of its products, the court judgement denies this right.

There is a court higher than the Supreme Court-that is the court of public opinion. It is there that the issue will be fatally decided.

Surendra Gadekar

This is based on articles in WISE and Sunday Mail.

LETTER BOX

Congratulations for publishing a very lucid article 'Another Pyrrhic Victory' in your journal, vol. 1 No. 4, February 1988. While agreeing with some of the observations such as ".......the group that suffers the hazards could be totally different", I would like to point out:i) that the anomalies of the earlier terms such as maximum permissible exposure or dose are removed in the presently accepted international terminology, dose equivalent, effective dose equivalent etc.2) It is preposterous to suggest that nuclear power is incompatible with indefinite sustenance and perpetuation of life on earth in time.3) The author has given us a succinct summary of the concentration process existing in the marine food chain webb, but fails to add that the concentration occurs with the diluted concentration of the pollutants due to mechanical convection.4)Citing D.D.T. alongside radionuclides just because both are considered *to* be toxic is not appropriate as radionuclides do not behave like DDT in the environment.5) I welcome the authors suggestion that all the geophysical aspects have to be taken into account in studying the problem of nuclear waste disposal in deep geological formations.

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Authors's Reply :

To begin with, let me thank Shri Sastry for reading my article with interest and, more so, for commenting upon it. Let me come to points of our disagreement.

We are residents not only of the external-physical world but also of the world of out languages. Every language has its own point of view and prejudices against other viewpoints. Therefore, certain ideas just cannot be thought of in a particular language. This is Whorf's linguistic relativity principle. That was exploited *in* George Orwell's "1984" to develop a language in which revolt against the totalitarian set-up could just not be imagined. That is precisely the game played by the nuclear establishment. Phrases such as maximum permissible exposure or dose, dose equivalent or effective dose equivalent are devised so that the physical reality of cumulative and irreversible damage done by nuclear radiation can be linguistically kept out. Earlier terms were "anomalous" because they did not serve this purpose, effectively. Hence the new terms. But this "progress by renomenclature" is deceptive and does not change the objective reality.

Unless otherwise proved, Gofman's view, that nuclear power is incompatible with indefinite sustenance and perpetuation of life on earth in time, may so depressing, frightening, horrifying, but certainly not preposterous. There is no way in which radioactivity can be prevented from doing the damage, nor is there any way in which increasing quantities of radioactive waste can be isolated for long periods. The only good news I am aware of is the work of Donald Cram, Charles Pederson and Jean-Marie Pierre Lehn in supermolecular chemistry. Their work raises hope of separating radioactive tissues *from* normal tissues in individuals exposed to radiation. But firstly, it is philosophically wrong to escape through hope and secondly, whereas ill effects of nuclear radiation will be freely available to all in the neighbourhood of a nuclear plant, the supermolecular chemical treatment could be afforded only by some, who would not be residing near the nuclear plant, in the first place. That is a general law of the distribution of "goods" and "bads" in the society. "Medicines are proprietary, but germs are free", Schelling had said. Therefore, to rely on distant hopes of supermolecular chemistry as an antidote to the malady freely dispensed by the nuclear radiation amounts to sacrificing some individuals for the benefit of others, or in other words, regarding some men as means. This is not in consonance with the modern (or even ancient) theories of justice such as Rawls's. I have an impression that here Shri Sastry agrees with me.

I have adequately mentioned that the density of pollutants gets diluted by convection and the biological concentration does act on these diluted pollutants. But it nevertheless does ample harm. Aquatic life and through multiply linked trophic chains **all** other life forms do suffer the damage. **That** most countries have, at least officially, given up discharging nuclear waste in the large water bodies, is proof enough that dilution due to convection currents is not an adequate safeguard.

I must apologize for citing DDT am! radionuclides side by side. That is unfair to DDT. It is a chemical and could be chemically decomposed in to nontoxic substances and therefore the problem posed by DDT can have a technical solution. Radionuclides cannot be neutralized thus. I had agested geophysical studies of the proposed nuclear waste disposal sites because I believe that such studies would prove that these proposals are untenable, as happened in the U.S. I am glad that Shri Sastry welcomes such exhaustive geophysical studies.

I must thank Shri Sastry for giving im this opportunity of offering amplification of my views.

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FUDGING THE ISSUE

The Truth About "Safe" Background Radiation

AMONG the most important dogmas held by the nuclear establishment worldwide is that "background radiation"—i.e. radiation from the earth and space (in the form of cosmic-rays), as well as from food, airplanes and machines, to which people everywhere are subjected—is safe. At least, it has not been known to cause any health damage, say the nuclear pundits.

This proposition is of critical importance in setting the "safe" or "maximum permissible" limits for radiation exposure of human subjects from mail-made sources, such as nuclear power stations and other atomic installations. The argument is that if background radiation (usually of the order of 100 to 150 millirem per annum) cannot cause any harm, then a little additional dose of ionising radiation from nuclear installations cannot damage the health of the normal population either.

That is how, in practice, the exposure limits (currently of the order of 500 millirem a year) are set for the ordinary people (as distinct from specialised radiation workers) who may live close to nuclear installations and face the potential risk of becoming their victims. That is how people who ought not to be exposed to any additional radiation at all arc asked to bear an extra dose of it , which they are told will not harm them in any way. Indeed, some scientists of BARC have even gone to the preposterous length of claiming that low doses of radiation may actually be beneficial !

There is growing evidence that the original dogma on which this self-serving inference is based is as false and pernicious as the conclusion itself. Studies from Australia and southern Africa suggest that "natural" Kickground radiation—like all ionising radiation in any form or dose -is harmful.

Of particular significance is a 1976 Indian study, remarkable at least partly because it was conducted by researchers of the prestigious All India Institute *of* Medical Sciences, New Delhi, which has devastating results as far as the nuclear industry's pet predilection about background radiation goes.

Published in *Nature*, the study was conducted by N. Kochupillai, I.C. Veima, M. S. Grewal and V. Ramalingaswamy in the coastal villages of Chevara-Noendakara in Kerala and Manavalankurichi in Tamil Nadu, which have high background radiation levels thanks to the presence of thorium-bearing monazite in the beech sands. It concludes that the prevalence of Down's Syndrome (or Mongolism, caused by a genetic abnormality) in the study population was significantly higher than in a comparable ("control") population which, however, lives under normal background radiation.

The Kochupillai study jolted the nuclear establishment throughout the world : while the prevalence of Down's Syndrome and severe mental retardation with physical abnormalities was only 0.17 per 1,000 in the control group, it was more than five times higher or 0.93 in the study groups. Hence background radiation at Chevara-Neendakara, variously estimated at between 342 millirems a year (BARC) and 1,500 millirems a year (WHO) must be considered definitely harmful. The nuclear industry's dogma thus falls to pieces.

The industry retaliated in the form of a reply by K. Sundaram (of none other than BARG), which contested some assumptions in the study pertaining to thortality and fertility age structure of the population. Sundaram estimated the frequency of Down's Syndrome in the "normal" population on the basis of certain western models and showed that the high frequency found in the study was not (statistically speaking) significantly higher.

The AI1MS group published a rejoinder to Sundaram, questioning some of his assumptions and conclusions on the ground that he had failed to consider the likelihood that if the infant and childhood mortality in India is about six times higher than in the West, the mortality of Down's Syndrome would also be substantially higher than *in* the West. If the higher mortality of Down's Syndrome is taken into account, then their original conclusion stands.

The debate thus ended with the substance of the Kochupillai study hypothesis remaining uncontested. But now, V.T. Padmanabhan, the author of two remarkable studies on the Indian Rare Earths plant in Kerala, has published a superb analysis of the entire debate. ("Radiation-Caused Genetic Diseases at Chavara-Neendakara in Kerala India : the Anatomy of a Non-Debate": in *International Perspectives in Public Health*, Vol-3, Issue 1, Spring 1987, pp. 20-25).

He shows that neither of the two contestants had taken into account the peculiarities of the area they had studied, viz. the low mortality rates in Kerala in relation to the country as a whole, the significant differences *within* Kerala between the lowlands (where the monazite sand belt is located) and the mid and highlands.

Padmanabhan brings to bear ou this analysis his knowledge of the state and his rich insights into its distinctive socio-economic features such as the fishing economy of Neendakara, the site of an Indo-Norwegian project for mechanised trawler-based fishing, the relatively advanced status of the health-care facilities in the village, and so on.

After a masterly analysis of the mortality, fertility and genetic abnormality rates in the study and control groups, he concludes that the Kochupillai team had *underestimated* the damage caused by exposure to radiation from the monazite sands. The frequency of Down's Syndrome at Chavara-Neendakara, he shows, is five times higher than in Trivandrumand in the country as a whole (excluding Madras) and as many as 16 tunes higher than iu Madras.

Padmanabhan's work has thus demolished the bogus assumptions and dogmas o£ the nuclear industry once and for all.

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RADIATION FACTS

Many Friends have said that Anumukti is getting too technical and is not for the uninitiated. From now on we will have a page for just that.

The type of radiation emitted from nuclear power facilities is called ionizing radiation ; it has the energy needed to remove one or more electrons from an atom. The ionization of an atom creates an ion which is chemically reactive and can damage living tissue. Ionizing radiation includes X rays, gamma rays and alpha, beta, and neutron radiation. Cosmic radiation and naturally occurring radionuclides (radioactive elements) such as uranium, radium and thorium all emit ionizing radiation referred to as natural background radiation. Ionizing radiation is also the type used in medical X-rays, and the type found in atomic weapons fallout and all phases of the nuclear fuel cycle from mining and milling to waste storage. The radionuclides are unstable and eventually decay through a decay chain to a stable element. Radiation is emitted during this process. The half life of a radionuclide refers to che tunc necessary for one-half of a given amount of it to decay.

When radiation strikes a person, one of four events may occur :

i) it may pass through the cell without causing any damage;
2) it may damage the cell, but the damage may be repaired;
3) it may damage the cell, but the cell may divide before being repaired;
4) it may kill the cell.

The last, two events are of concern to human health. Ce Killing is often harmless unless enough cells in a particular tissue are killed, rendering it incapable of functioning. Medical radiation therapy uses the cell-killing effect *of* radtation to kill cancerous cells. The third effect, incompletely or incorrectly repaired cell damage, may eventually result in delayed health effects such as cancer or be passed on to future generations as a genetic defect.

Total body radiation involves the exposure of all organs. Gamma radiation is the most highly penetrating form and creates, the most damage as it passes through the body. This is also true of X rays and neutron radiation. Alpha and beta radiation, which have low energies arc not serious external threats, but if ingested or inhaled they are extremely harmful to the organs or tissues in which they lodge.

The most common measurements of human radiation exposures are rads and reins. Both refer to the actual amount of radiation absorbed by the body. The rem is a more precise measurement of the actual biological damage done. Because the rem is an inconveniently large unit for radiation protection purposes, doses arc often expressed in millircm (mrcm). One rem equals one thousand millircm. When referring to the collective dose received by a certain population the dose is generally expressed in man-rems. This is calculated by multiplying the total number of people exposed times their average individual dose. For example, 10,000 man-rems is the dose received by 5,000 persons each exposed to 2 rems, or by 10,000 persons each exposed to one rem, or by 20,000 persons each exposed to 500 mrem. Current guidelines recommend the general public receive no more than 500 mrem per year.

Inside the human body, many radioisotopes are concentrated in a specific organ, meaning that most effects of the radiation arc concentrated into a small area.

Radiation emitted from nuclear power plants occurs in the form of several radioisotopes. Routine operation of a nuclear reactor includes occasional releases of radionuclides that have built up within the reactor system. Some of the isotopes routinely released are tritium (radioactive hydrogen), iodinc-131 which has a half-life of eight days, noble gasses (argon, xenon, and krypton), cobalt-60 which has a half-life of five years, strontium 90 which has a half-life of 28.5 years, and cesium-137 with a half-life of 30 years.

Noble gases are inert, meaning they do not chemically interact with the body. but they arc capable of decaying to elements which are not inert and are concentrated in the body. For example, xenon can decay to isotopes of barium, cerium, and cesium; and krypton can decay to strontium and yutrium.

Once radiation has been released it is dispersed by the wind and is brought down by gravity, rain, snow and fog. If winds are calm the radiation will just deposit near the base of the stack. If the radiation drifts over a city where it is raining most of the radiation would be deposited there.

After radionuclides reach the ground they can be absorbed by plants and people. It is possible to receive direct radiation from the nuclides at ground level and to receive a radiation dose through the inhalation or ingestion of contaminated materials. Many plants and animals which arc important human food sources are known to concentrate several radionuclides. Tor example, iodine is concentrated in milk; strontium is concentrated in milk, root vegetables and animals.

Many types of cancer are known to result from radiation. The most common type is leukemia, but recent studies have shown that bone marrow and soft tissues like the pancreas, brain, kidney, lung, and large intestine also develop radiation induced cancers.

Protest in Russia

In respvise to pressure from local residents, Soviet authorities have halted the construction of a nuclear power plant in Krasnodar, north of the Caucasius mountains, near the Black Sea. This news was reported in the paper Komosomolskaja Pravda on 27th .January 1988, which also stated that there is bitter, opposition to most of the nuclear plants under construction, as well as to those alredy in operation. These announcements arc the strongest acknowledgement yet that there is strong public opposition to nuclear energy in the USSR.

Before the Chernobyl accident, when it was considered prestigious and profitable to have a nuke in your neighbourhood, the local authorities in Krasnodar requested a nuclear plant in their area to make up an anticipated shortfall of energy in the northern Caucasius. However, after Chernobyl attitudes changed rapidly. Twenty-five million Roubles had already been spent on construction of the Krasnodar plant when the local officials gave in to public pressure and cancelled it.

This is the first time that opposition has actually halted construction of a nuclear plant in Russia. Public concern has lead to the suspension of work at another power station near the town of Clugrin in the central Ukraine.

The development of open opposition to nuclear energy also points to the growing power of public opinion in Soviet politics. In the past intellectuals had been known to express their opinions to the leadership on important issues. Until recently, however newspapers would rarely give such opoinions space if they contradicted the official viewpoint.

A backlash against nuclear energy would create a serious dilemma for the Soviet leadership, which is basing much of its development plans on the assumption that nuclear energy will play an increasing role in supplying power. At present, there are plans to build six new 1000 Mw reactors in the Ukraine, each of which would be based at one of the seven existing power stations in the republic. In some cases the result would be a group of reactors at a single site producing up to 6ooo MW of electricity. A recent review carried out by various institutes of the USSR snd the Ukrainian Academics of Science had reached the conclusion that no nuclear power stations execding a total output of 4000 MW should be built. The option of opening new sites is slowly being foreclosed by growing public opposition. The authorities would be better advised in giving up their fascination for nuclear power, rather than in digging the foundations of a deeper tragedy in the future by making the existing power stations too large and unwieldly.

Sources : *WISE News Communique* : 287.2912
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ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

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Some say the world will end in fire,
Some say in ice.
From what I've tasted of desire
J hold with those who favour fire.
But if it had to perish twice,
I think 1 know enough of hate
To say that for destruction ice
Is also great
And would suffice.

Fire and Ice. *Robert frost*

Dua, my daughter, is five years old. She radiates joy and the last five years have certainly been amongst the happiest of my life. But sometimes I feel it is a dream with the external world rudely knocking to shake me out of this idyllic state.

The reality outside is harsh. The horrors of nuclear holocaust are just a button-push away. But even without that ultimate fire, scientists estimate that more species of flora and fauna shall become extinct within our lifetimes than have done so in the last fifty million years toge her. The last great miss extinction was sixtyfive million years ago when dinosaurs and rainy other species made their exit. Even that mass extinction, which torn; speculate was caused by the impact of a large meteorite on earth which raised a lot of dust and completely changed weather patterns, did not bring such sudden death. The lifetime of a species ranges over hundreds of thousands to millions of years. A century is like the proverbial blinking of an eyelid. Yet we have managed to poison our planet to such an incredible extent in this short time that hundreds of species will be becoming extinct everyday. The much heralded dawn of the 21st century is a time of doom for a lot of our fellow beings. The Greenhouse effect, Acid rain, 'Ozone hole, Soil erosion, Deforestation and Desertification, Radioactive and Toxic waste are just a few signboards on this route to global catastrophe. Our own local hells - terrorism and (en)counter state repression,-Punjab and the northeast-hegemonistic adventurism in Srilanka, never ending violence against adivasis, harijans, minorities and women -endemic starvation ni Kalahandi and the deepening drought in Gujarat, etc seem like eddies In this flood towards doom.

Our very existence today depends on the products of modern industrial processes. All these processes have two common characteristics : they guzzle limited resources and they produce ever-growing wastes. Even if we confine ourselves to energy generation alone, all forms of bulk' production, coal oil, nuclear and large dams arc both hazardous and polluting. The coal versus nuclear controversy, so dear to energy planners, is akin to condemned prisoners on death row expressing a preferrence for the electric chair over the gas chamber. We need a way out which affirms life rather than death.

In *'A Study of History"*, Toynbee noted that civilizations decine when they fail to find adequate responses to the challenges that face them. The recurrent and ever virulent problems that confront us only attest to the bankruptcy of the universally adopted modern materialism. The touching faith in the ability of SCIENCE to solve all the problems it has spawned needs to be recognised for the superstition it is. It is only when we realize that we have reached a dead end, that we can begin the search for a way out.

Wherein lie reasons for hope ? Hope lies in the spread of ecological consciousness in the young. It lies in the recognition that humans are not the "centre of all meaning and the source of all value"-that material consumption is not what being human is all about. Hope lies in the vision of Gandhi, of Tolstoy, of Thoreau and Emerson - a world in which all creation can live together in peace and respect.

As long as we remain convinced that we arc the measure of all that is, that the world is a mere store of resources for gratifying our whims, there is no alternative to fire and ice - a very apt metaphor for nuclear winter. All our Duas (an arabic word meaning both prayer and blessings) deserve better.

Surendra Gadekar

American Nuclear Resistance—1987

The number of arrests for anti-nuclear civil disobediance in the United States and Canada increased in 1987 by nearly 60 % over recent years to a total of over 5,300. Statistics compiled annually by the Nuclear Resister newsletter show that the current figure equals the record number of arrests reported in 1983, the year of Euromissile deployment and massive demonstrations in the United States and Europe.

Most of these arrests were weapons related and occurred at military facilities, war contractors and federal government offices. About 400 of the total were of people protesting nuclear power, uranium mining and related projects.

As a consequence of these arrests, over 120 people served or are serving prison sentences ranging from two weeks to 17 years. Hundreds more served lesser sentences.

Action groups all across the continent, some in loose coalition with others, but for the most part acting independently, engaged in over 180 separate actions in 1987 at more than 70 different sites. (Of the total arrests, 95 were reported from Canada, during nine actions at three sites.)

The Nuclear Resister newsletter, edited and published eight times each year in Tucson, Arizona, by Jack and Felice Cohen-Joppa, is a source for comprehensive information about anti-nuclear civil disobedience in the United States and Canada. Subscriptions are $15/10 *issues from the Nuclear Resister, P.O.Box* 43383, *Tucson, AZ* 85733 *U.S.A.*

ANUMUKTI DAY-1988

KARNATAKA

Chernobyl day was commemorated in Karnataka as 'Anumukti' day. The emphasis was on educational and cultural activities. A group of ten activists who had met for a preparatory meeting beforehand felt that an impasse had been reached with conventional forms of protest, especially marches to the chief mi listers residence and that something novel needed to be done to capture the imagination of youth.

For the programme in Bangalore, a number of different groups cooperated and worked together as a unit. Amongst these were CIEDS collective, Prarambha, Samagra Vikas, and the Progressive Youth Centre. A number of activists observed a one day fast as an expression of commitment to the anti-nuclear cause. The programme was formally inaugurated at 8 AM at Minsk Square by the exhibition of black and white sketches of Shri B.K.S. Varma. A workshop was conducted by the group Media Exploration for Social and Cultural Advancement (MESCA). In the workshop, ways of fabricating Demon Heads were demonstrated. These demonheads were later used in a procession in the evening. Activists of Bingalore are specially thankful to Shri Shashi Adappa and Shri Rajendra of MESCA for their help.

About 4 PM in the evening, mask wearing and slogan shouting activists of the progressive Youth Centre (PYC) commenced a cycle rally. Taey went to different parts of the city and distributed anti-nuclear literature.

Throughout the day a group of three singers who had come specially from Raichur to participate in the programme, sang songs describing the damage done by the destruction of the Kaiga forest. The songs which were based on Kannada folk tunes were much appreciated. A lot of people cams forward and expressed their solidarity with the activists. A lot of posters were punted and exhibited. There was a magic show by Raaj the magician.

At 5.30 in the evening there was a protest march by about 250 protesters. The protesters were holding banners, posters, placards and demon-heads. Others formed a human chain, from Miask square to Cubbon Park Bandstand. Later in the evening the rally converted itself into a meeting. There was an impromptu performance of Yakshagana on the subject of Nuclear Demon. Besides there was a folk song and dance performance by the group from Raichur and some PYC activists. The meeting was addressed, among others by Shri H.S. Doreswamy, Dr.Ramachandra Guha, Dr.Nagaraja Rao and Shri Suresh Heblikar.

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ANDHRA PRADESH

Citizens against Pollution (CAP) has decided to launch a protest campaign against the siting of a nuclear power station near the Nagarjunasagar dam. The campaign will concentrate on the command area of the dam on the Krishna river.

Mr.K.Purushottam Reddy, a college professor in Hyderabad, and the president of CAP told a news conference that an anti-pollution 'Prachar Ratham' (propoganda chariot) would tour the area fron Nagarjunasagar to Khammam as well as Vijaywada and Guntur, to spread awareness amongst the people of the dangers of radioactive contamination.

At the same time a group of lawyers had come forward to file a public interest petition in the high court to prevent the nuclear power board from going ahead with the project.

Prof.T.Shivaji, of the Andhra university, told newsmen that atomic energy officials "are taking us all for a ride" and not following known safety rules including those laid down by the atomic energy commission itself.

Prof. Shivaji said that the Nagarjunasagar project did not men stipulated criterion. Vijaypuri, a township of 40,000 was within 16 Km, of the site. The tiger sanctury, the historical museum of ancient Buddhist monuments of Nagarjunakonda, tourist centre and the Sagar lake with abandant fish, all lay in close proximity of the reactor site. He said the nuclear plant would discharge 3000 million gallons of hot condensor cooling water at a temperature ten degrees Celsius higher than the ambient temperature of the river water. Due to this massive discharge, there will be drastic reduction in the oxygen content of the river which would result in high mortality in the fish.

Times of India : April 28, 1988

GUJARAT

Kakrapar, in south Gujarat, is the site of two 235 MW reactors under construction. The construction began in 1980 and at present the authorities expect the reactors to become critical sometime in 1991. As regular readers of *Anumukti* would be well aware, a local agitation of somewhat sporadic character has been going on since 1985 opposing the construction of the reactors.

For quite sometime past activists had felt the lack of statewide support for the Kakrapar agitation. This lack was attributed to the fact that no campaign on a statewide basis had been conducted to educate the people about the hazards of and the inequity and the injustice involved in the nuclear enterprise.

At the last meeting of Gujarat Anu Urja Jagruti, it was decided to observe Chernobyl day by having a march from Kakrapar to the state capital at Gandhinagar - a distance of around 400 Km. (Sec *Anumukti* vol.I No.5) Originally the idea was to travel the whole distance in a bus with programmes of public meetings, poster exhibitions, video shows, etc on the way, but a suggestion from the students of Sampoorna Kranti Vidyalaya, made for a happy change in the programme. They concieved the idea of a cycle rally for the whole distance. There were some logistic problems in this, but in retrospect, the cycle rally turned out to be the major component in the success of the whole venture.

The march started from Kakrapar on the 19th of April and proceeded to Gandhinagar with halts at Bardoli, Surat, Ankaleshwar, Bharuch, Baroda, Anand, Nadiad and Ahemedabid. Besides eleven cyclists, there were eleven others who covered the distance using state transport buses, trains and in the latter part of the journey, a jeep.

Public response to the rally was very encouraging. The cyclists who carried posters and wrote slogans on the road-side were often cheered and received enthusiastic welcome in many villages. Some roadside cycle repairers even refused payment for the repairs carried out by them saying that they too wanted to be part of the march. During the march, thousands of handbills were distributed. A lot of copies of two antinuclear booklets in Gujarati were sold and *Anumukti* has 21 new subscribers.

The three press conferences held at Surat, Baroda and Ahemedabad were well attended and the issue was extensively reported in both the Gujarati as well as English newspapers. Most of the leading Gujarati papers had editorials which commented favourably both on the anti-nuclear stand as well as on the way the rally was conducted, contrasting it with the fake 'Dandi March' indulged in by the Prime minister just a few days previously. The march was also mentioned prominently in local radio and TV news bulletins.

On the 26th of April the march concluded by submitting a memorandum to both the governer and the chief minister of Gujarat at Gandhinagar. The demands in the memorandum were : 1) That a national debate be conducted at various levels so that a national consensus can be established on nuclear activities in the country, 2) Till such a consensus was established, there be a moratorium on new plant construction and 3) Information regarding nuclear activities be made freely available to citizens and the cloak of secrecy surrounding them be lifted. The chief minister expressed his inability to do anything about the demands since atomic policy was decided in Delhi but agreed to convey the demands to the Prime minister.

As part of the next phase of the programme, a necessity was felt of preparing a number of small (32 pages) booklets highlighting different aspects of the nuclear issue in Gujarati and Hindi. Also special efforts need to be made to contact different amateur theatretical groups to stage plays on anti-nuclear themes.

Surendra Gadekar

An Appeal

A large part of the milk distributed by the urban dairies in Bombay, Calcutta, Delhi and other cities in India is likely to be radioactively polluted. Our National Dairy Development Board, a Government of India organisation, has contracted for imports of 75,000 tonnes of milk powder and 2$,ooo tonnes of butter oil from European Economic Community (EEC) countries and a part of this consignment is expected during the ensucing months. The EEC exports of dairy products, since Chernobyl atomic disaster in April 1986 were found radioactively polluted and millions of kilos of milk powder, butter oil, etc were rejected by Afro-Asian Countries including Phillipines, Malaysis, Singapure, Sri Lanka, Bangladesh, Pakistan, Nepal, Angola, Ethiopia, Ghana, Mozambique, Somalia and others. But India has been a sole exception. India does not have a compulsory statutory check for detecting radioactivity in foodstuffs at its ports of entry, though our Bhabha Atomic Research Centre (BARC) carries out such tests if and when a sample is sent to them. However, BARC has failed to enforce any scientific statistical design of sampling and in most instances the representative character of the sample vis-a-vis the imported consignment is in serious doubt. Nevertheless BARC have issued certificates regarding its fitness for human consumption.

We therefore approached the Supreme Court and petitioned for a restraint and ban on imports of such dairy products from EEC countries. But Government institutions and Government Scientists opposed our petition and Supreme Court rejected our plea despite advice and warnings about genetic damage and cancer from Nebel Laureates, Dr. Linus Pauling and Dr. Geroge Wald. The conscience of the nation has been shocked by this callous attitude of the Government towards public health hazards. Numerous consumer associations have requested the Supreme Court to reconsider its decision and we have filed a Review Petition. We have also requested the Prime Minister to intervene and stop imports immediately. The former Chief Justice of India, Mr. Y. V. Chandrachud has called the Supreme Court verdict a monumental error. In the British Parliament, fiftynine oposition MPs have given a Notice of Motion for investigation to ensure that no radioactive foodstuff will be shipped from UK to the Third World countries or from European countries to UK. In Khatmandu, Nepal, widespread consumer resistance has disrupted the distribution of recombined milk by government dairies.

Consumers health is in danger. Infants, children and pregnant women will be the worst sufferers. Future generations too may suffer from genetic damage and higher risk of cancer. We, therefore, urge upon you to act now and force the Government to ban imports of all milk products from EEC countries. People must raise their voice and assert at all public forums to stop the import and distribution of radioactively polluted milk products in India.

Maharashtra State Government Employces' Confederation.

Chernobyl in PM's Kitchen

Rumours claim that Motilal Nehru, our present Prime minister's great grand father used to get his laundry done in Paris. I never gave credence to these rumours till I read the following story in the Indian Post of April 26th, 1988. *We are reproducing it for its surreal quality and the light it throws on the extravagance of our rulers.*

A few hand-picked ' scientists in the employ of the Department of Atomic Energy have been entrusted the special responsibility of testing for radioactivity, the food consumed by Rajiv Gandhi and other VVIPs.

Armed with a string of university degrees and gamma spectrometers, they probe deeply into the Prime Minister's food to ward off nasty maladies that could arise from Chernobyl's malignant isotopes.

The list of people they protect is select, an exclusive club which includes the Prime

Minister, the President and the Vice-President and their immediate families. Any morsel in their list of edibles that originates from countries affected., even remotely with the Chernobyl fallout, is scanned by powerful radioactivity monitors at the Bhabha Atomic Research Centre here.

For the last 18 months, they have seen, inspected and passed every edible item consumed by the Prime Minister originating from Europe. And in the instances when they have not been able to cart the food to their laboratories, the scientists have jet-hopped continents chasing VIP food.

The exercise began shortly after the Chernobyl nuclear disaster when the Director-Gsicral of Health Services in New Delhi sensed dinger to the PM's health and issued a directive that all food coming from Europe and reaching Rajiv Gandhi's plate be first tested for radioactive isotope Cesium-137.

Since then, the PM's food has been taking a long and winding route. After its flight from the West to New Delhi, a portion is selected as the Prime Minister's feed for the next week to fit a menu attested to by his kitchen staff. The food, comprising meat, bread, select vegetables and even chocolate and cookies, is then packed into 500-gm pickets and flown to Bombay, and from the airport here, brought by special escort to BARC's testing laboratories for priority analysis.

The samples are checked, cross-checked and then verified by a head of department before a copy of the report is sent to the Director General of Health Services, and the food returned to New Delhi.

And when the PM leaves the country, the food leaves with him. In fact, for every kilometre he travels out of India, his food would have traversed more than twice that distance.

For the BARC laboratory, which receives about 2-3 kg every 15 days while the PM is in the country, the real task begins when he is set to tour the world. The Director-General's office had initially toyed with the idea of testing only the PM and his family's food, but decided against it because of the possibility of the untested portion landing on his plate, and the 'safe' special meal going to some inconsequential bureaucrat or journalist.

So the lab has to test all the food that enters Gandhi's special Jumbo aircraft. Which means that about 12-15 kg of samples arrive in Bombay about 3-5 days prior to the journey for Cesium-137 testing.

Incidentally, BARC has seldom performed similar tests for general consumer products, the one exception being that for the imported butter. Other items purchased from Europe, including meat, special seasonal vegetables and even the assortment of chocolates available here for general consumption, do not go through any isotope-test.

DAE scientists say the tests arc not necessary any m>rc as radioactivity levels are dropping. Now they stand at 3 becquerels per kg against the permissible limit of 40 becquerels. And how long would they continue the test ? "Till he Director-General issues a fresh directive."

Courtsey : R.S. Venkatesh, Indian Post.

Heavy Water Theft

Norway has confirmed persistent reports in the press that in 1983 consignments of Norwegian heavy water were diverted and sold in the international black market. Investigations arc still continuing but reports speak of at least two separate consignments of 15 tonnes each which were hijacked from W. Germany and Roumania. India has been mentioned as one of the possible recipients of these stolen goods. It is difficult for the Indian Atomic Energy establishment to deny these allegations since in 1983 India was desperately searching for heavy water to start the first unit of the Kalpakkam reactor (MAPS-I) near Madras.

The Kalpakkam reactor had been completed in 1980 and was not being started mainly due to a shortage of heavy water. The requirement tor a plant of its type and size is around 250 tons for start-up and about 20 tons per year thereafter. India does have a number of heavy water plants of its own but their performance has never been anything other than poor. (See the story on the Tuticorin heavy water plant in this issue). The Tuticorin (67 tons/year) and Baroda (70 tons/year) plants were then (and have been since) in constant trouble. (Only recently the Baroda plant had a big fire). The Talcher (67 tons/year) has never got off the ground. The old Nangal (14 tons/year) plant was at the time not producing up to capacity due to frequent power cuts in the region.

Thus, the main question remains : how did India manage to get the 250 tons of heavy water to start MAPS-I reactor when all its heavy water units were non-performers ? The establishments answer to the question has been to ignore the question altogether, put up a bold front by claiming that India used its own heavy water. The annual reports of the establishment which used to be more open on the performance of the heavy water plants, suddenly became more restrained and less communicative. This was also the time when, within the establishment, the heavy water directorate under Dr.N.Srinivasan was facing rough weather and a running battle between Dr. H. Sethna, Dr. Raja Ramanna and Dr. N.Srinivasan ultimately led to the latter's exit. The only answer the establishment has given to the charges is that it had adequate heavy water from the small levels of output of the Tuticorin and Baroda plants over the years 1978-1982 to build up enough stocks to run the MAPP-I unit. However the quantity has not been disclosed beyond saying that the unit needed 250 tons. Outside observers have speculated that India bought heavy water clandestinely on the international black market since this commodity was very much for sale following a glut in its production abroad. Others have alleged that India diverted heavy water from the non-working RAPS-I unit in Rajasthan, without anyone coming to know about it, under the guise of upgrading the heavy water.

One option which was open to India at the time, was to openly import heavy water from the Soviet Union as was done in the case of RAPS-2 unit. However, any open import would have meant full cope inspections by inspectors of the International Atomic Energy Agency (IAEA). This would have meant very close tabs being kept on the Plutonium produced at the reactor. To a country engaged in "keeping the nuclear option open" this was totally unacceptable. Smuggling and stealing was considered preferable.

The nuclear power target of 10,000 M\V by the year 2000 also depends heavily on the success of the new set of heavy water plants coming up. Tuticorin and Baroda plants were set up with forign technology. The subsequent plants have been based on indigenous developments. The hydrogen sulphide water exchange process demonstrated successfully at Kota has provided a method of setting up heavy water plants without depending upon the undertain supplies of synthetic gas from fertiliser plants. The only drawback at Kota was the poor supply of process steam from the nuclear power plant. This is being corrected in the subsequent design of such plants like the one at Manuguru.

The capacity of the new plants is also somewhat highcr-130 to 200 tons per year. To fulfil this targer of 10,000 Mw a capacity of 13000 tons of heavy water would need to be built up. The establishment own feeling is that all the 'teething' troubles of heavy water production are now over and the country is well on its way to self suffiency. In case this confidence turns out to be unjustifed, well, the international black market beckons.

Sources : Heavy Water Politics Runs Deep-
Rajendra Prabhu Hindustan Tunes
15.5/88

New York Times : 8.5/88

LETTER BOX

Nobody Wrote

The Perils of Tritium

Tritium is an extremely' paradoxical and dangerous material. On the one hand, it is a key material in hydrogen bombs and is produced in highly concentrated forms in special military reactors; on the other hand, tritium is generated as a waste product in nuclear power plants and is released to the environment as there are no financially viable techniques for separating it from effluents.

The nuclear establishment has always propagated the view that Tritium is one of the least hazardous forms of radioactive waste, thus justifying massive releases to the enviroment. The truth of the matter though, is that the retrieval of tritium from waste streams is costly and would cripple the nuclear industry financially. As a consequence, the enormous body of scientific evidence disproving low toxicity claims for tritium is callously brushed aside.

Tritium (T) is the heaviest isotope of hydrogen. It is formed naturally in the atmosphere by the action of cosmic rays. About 1.8 to 2 million Curies (MCi) are formed every year, (a Curie (ci) is an unit to measure radioactivity. It is the activity of 1 gm. of radium and corresponds to 3.7 x 10^{10} disintegrations every second). The total glogal inventry due to natural causes is around 36 MCi. Tritium is a 'beta emitter with a half-life of 12.35 years. As an isotope of the lightest element, gaseous tritium reality diffuses through most materials, including steel and rock.

Today natural production of tritium is vastly overshadowed by nun's nuclear activities. On a worldwide scale, the atmospheric testing of nuclear weapons between 1945 and 1962 is still probably the predominant source of environmental tritium. During this period between 6800 to 8000 MCi were released into the biosphere. It will take until the middle of the next century before this tritium has decayed to a level equal to the natural global inventory.

The scale of, the present day tritium discharges is a cause for still greater concern, however, in the sense that we have no say over history. The amount of tritium being released to the environment today on a routine basis greatly exceeds natural production and is increasing every year. Discharges are mainly in the form of tritiated water (HTO) or tritium gas (HT_2 or T_2). Because tritiated water is of chemically identical to 'normal' water (H_2O), tritium constitutes a unique environmental contaminant : unlike other radioactive and chemical pollutants, suspended or dissolved in the water body, tritium contaminates the actual water molecule. There arc no financially viable means of removing tritium from effluents - or drinking water-ana the radioactive HTO streams into exactly the same bilolgical pathways as H_20, entering all living organisms and thus gaining access to metabolic and genetic processes.

The main sources of environmental tritium today can be summerized as follows : the civilian nuclear fuel 'cycle', involving power reactors, waste storage and reprocessing facilities; the military fuel 'cycle' of the five permanent members of the UN security council, involving specialized reactors for plutonium and tritium production, propulsion reactors for nuclear submarines and surface vessels, reprocessing plants, weapons plants and waste dumps; nuclear R&D establishments, comprising laboratories, test reactors and fusion research centres; miscellaneous civil applications, for example, luminous paints, 'starters' for fluorescent lighting, gas chromatographs, tracing materials (oil and gas exploration, hydrological studies) and medical applications as well as current nuclear weapons testing programmes and weapons sites.

Editors comment :We in India need to take special notice of tritium since the Indian nuclear programme is based primarily on CANDU type of reactors. Generating just 1000 MW of electricity in a CANDU also means producing 2.4 MCi of tritium. Thus, if our current plans of producing 10,000 MW by the year 2000 do materialize, we would usher in the new century producing 12 to 13 times the total 'natural tritium production. Around 400,000 Ci of this huge pile would be discharged to the atmosphere in the natural (no accidents) course, every year after a few years of reactor operation. In case of any accident; massive amounts of tritium would comaounatc the environment and produce a substantial impact.

Besides the tritium released by the reactors, reprocessing of the fuel elements to recover plutonium would mean additional substantial releases.)

Tritium Toxicology

An overwhelming body of evidence reported in scientific journals deals specifically with the perils of tritium. However, ICRP (International Commision for Radiological Protection) recommendations 26 and 30, (the latter dealing specifically with tritium) are in contradiction to this evidence. As has often been said, legislation on radiological protection serves to protect the nuclear industry rather than its victims.

In the following we shall briefly summarize the evidence on tritium.

1) Tritium intake by the human organism is not limited to HTO. Because tritium is also assimilated in various forms by plants and animals, human food is also contaminated. (Gi 76, Ki 82)

2) Tritium assimilated from HTO by plants and animals is not only retained in cell fluids but is also, in the course of metabolic processing, assimilated in all sorts of biochemic molecules. This organically bound tritium (OBT) has the capacity to cause much greater biological damage than HTO. For instance, in their tritiated forms, luccine (a protein precursor), uridine (RNA precursor)and thymidine (DNA precursor) are; respectivly, approximately 10, 100, and 1000 times more toxic than HTO (Ry 79). In the case of newly formed cmoroyos, T-thymidine is 5000 times as damaging as HTO (Ya 94.). This *is* because OBT is better 'embedded' biochemically in the organism and hence has a far longer biological half-life, than HTO : between 400 and 600 days, as compared with 10 days for HTO (C_2 8_4). ICRP 30 chooses to neglect the effects of OBT and bases its recommenations on a biological halflife of 10 days for all 'tritium. "(Biological half-life is the time elapsed before half the absorbed tritium is eliminated from the body by natural processes).

3) In the tissues of animals consuming tritiated water, the ratio of hydrogen to tritium atoms in . OBT is two to eight times higher than that in body water (K_2 77. Za 79). This is extremely relevent when considering contamination of food with tritium, and also when assessing incorporation of tritium into our own bodies.

4) Tritium accumulates on an organ specific basis, especially in the ovaries and the testics. This effect is reinforced if tritium intake is in the form of OBT, i. c. tritiated food (Pi 82). ICRP 30 assumes that tritium is uniformly distributed in among the soft tissue.

5) Tritiated molecules are passed on to growing embroyos across the placental barrier. Experiments have demonstrated that, from generation to generation, the specific activity of OBT in various organs increases, especially in the ovaries (Pi 82). The highest specific activity is observed in the DNA fraction, and the weight of the brain and the genital tract organs is decreased (Za 79). Offspring arc found to have a decreased number of primary oocytes (Do 79a) (Oocytes are ovary 'Preamers'. At birth, all female mammals have a limited but sufficient store of such cells, which develop into fully fledged ovaries later in life. Primary oocytes are formed only during embryonic development.)

6) Virtually all the experimental work on radiotoxicology of tritium has been performed on rodents. However, Dobson (Do 79a) has shown that monkeys arc considerably more sensitive than mice - particularly as regards damage to primary oocytes.

7) Experimental microdosimetry of such low energy beta-emitters as T is difficult. Mathematical models are being used to perform dose calculations (Co 82, Jo 84). These models locus only on the energetic aspects and miss many biological effects. in the case of tritium decay at least three factors are involved : a) transmutation to a helium-3 nucleus, whereby T incorporated in OBT leaves behind a 'gap' (destruction of hydrogen bridges in DNA; (LW 79); decay of T incorporated in the 5 position of certain DNA precursors produces mutations during DNA replication at

a rate approaching 100% (Kr 76), b) the recoil momentum of the nucleus in beta dcay is sufficient to break other C-H bonds and allows substitution of T in any position occupied by a hydrogen (NC$_{79}$); and (!) ionization of cellular water, with the formation of hydrogen peroxide, a cell toxin (Re 85).

8) As is the case with most environmental contaminants, virtually all the discussion of tritium focusses on human health, plants and animals being included in so far as they serve food for man. Many of the above mechanisms play an equally important role in the rest of the biosphere, however, with biological damage being recorded following surprisingly low concentrations of tritium contamination (Ab 79).

9) A problem deserving special attention is that of the passible connection between discharges of tritium on the vitality of forests. Reichelt has found a correlation between forest die-back and plumes from nuclear facility stacks (Re 85) Mist droplets containing hydrogen peroxide arc considered by some investigators to constitute a major cause of forest die-back,, possibly even more significant than SO_2 and NOx (S1 86).

10) A recent detailed epidemiological study (Be 85), has revealed a clear link between prolonged exposure to low levels of tritium and the occurence of the cancer of the prostrate. The study analysed the records of more than 39,000 people of both sexes who had been employed since 1946 at British atomic energy facilities. Some 3400 of these had died, of whom 38 of prostatic cancer while between the ages of 15 and 74. In those men who had been exposed to tritium, mortality from this form of cancer was 8.89 times the national average.

Within a 65 Km radius of the U. S. Savannah River Plant, where massive amounts of tritium arc released to the environment, doctors identified in 1983 at least 25 cases of the incurable and extremely rare blood disease polycythemia vera, a number significantly higher than the U.S. average. The disease involves an abnormal growth of all types of blood cells, and Can lead to leukemia, cardiac diseases and brain haemorrhage.

In summary, tritium contamination of the biosphere as a whole constitutes a far greater problem than is commonly supposed. From a wide variety of sources, tritium is released to the environment in extremely large quantities, on a routine basis. It gets incorporated in all biochemic molecules and has been shown to have deletrious biological effect at low levels of exposure. We must address the problem of radioactive contamination seriously, on a worldwide basis. Clearly, the ICRP recommendations are very unrealistic, even given only the specific research concerning tritium.

It should be added the same basic biological hazards arc associated with carbon-14, another radionuclide routinely discharged by the nuclear fuel cycle. Although the quantities released are far smiller - though still considerable - the long half-life of C-14 (5730 years) means that the consequences of the lack of management today will be felt for many milennia to come.

Unless serious measures are taken to phase out nuclear power and weapons, the whole biosphere will become seriously tritiated besides getting contaminated with numerous other persistent radionuclides. The problem is not being taken seriously anywhere in the world. One of the solutions considered by Canada is to extract tritium by cryogenic techniques from the tritiated heavy water moderator in CANDU reactors. This solution (which would appeal greatly to Indian nucleocrats - Ed.) is worse than the original problem since the major use of large amounts of tritium is in thermonuclear weapons.

Thus, the military-industrial complex continues to poison the earth and to threaten us with ever more weapons of mass destruction. It is time for a change, while there is yet time.

Nigel Hark

Nigel Harle is a Dutch antinuclear activist. An autodidact,' who follows his common sense, reads the literature and unencumbered by considerations of career, speaks out where others remain silent. He has compiled 'Tritium fact sheet' from which this article has been extracted

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Victory at Shoreham

New York State and Long Island Lighting Company (Lilco) have reached agreement that is likely to result in the abandonment of the Shorcham nuclear power plant in Long Island near New York City. It would be the first time in the United States that a fully completed nuclear plant was shut down before it began operating. With this the U.S. has joined Austria and the Phillipincs - nations which have drawn back from the brink by abandoning completed nuclear plants before they became critical .

Expenditure on the Shorcham plant now exceeds $5.3 billion and the interest and other financial charges are accumulating at the rate of $35 million per month. In dollars pec kilowatt, no U.S. power plant has cost as much as Shorcham, and no generating capacity of any kind has taken as much time to complete.

Moreover, the Shorcham plant is at the centre of a controversy that has ramifications- for all the 103 nuclear power plants operating in the United States as well as the 21 under construction. For example, the $4.5 billion Scabrook nuclear plant, on the New Hampshire coast near Massachusetts, is in much the same situation as Shoreham; it too has been completed but has yet to obtain an operating license.

It was in 1968 that Lilco formally applied to the U.S. Atomic Energy Commission for a construction permit to build a nuclear power station on Long Island. The plant was expected to cost between $65 to $75 million and to be on line by 1973.

Enormous opposition to the plant developed because of the concern that Long bland could not be safely evacuated in case of 2 nuclear emergency. Fears of an accident have been dominant in the minds of the residents of Long bland ever since the Three Mile bland accident in 1979. It was only after that accident that the Nuclear Regulatory Commission (NRC) formally incorporated emergency planning into the process for granting operating license. Suffolk County (*in* which Shorcham is located) and' New York State have both maintained that evacuating the area around Shorcham is impossible for geographic reasons. Thus, inspite of the fact that Shoreham was the most inspected plant in the United States and had many additional safety devices over and above those required by the NRC, it was unable to obtain a license. To the opponents, the real issue was one of local control Over local affairs - whether local communities have the right to decide to have an enormously hazardous plant in their midst. As Wayne Prospect, chaiman of the energy committee of the Suffolk County legislature, said, "How we will turn our lights on - that's a question we will solve".

Editors Note : The Shorcham saga is an inspiring tale for the antinuclear activists everywhere. It demonstrates the power of an awakened public opinion. The issue, which began as a purely local issue escalated first into a statewide and then into a national issue. Its denouement has long term implications for the future of nuclear industry everywhere. A lot of litrature is available on the full story of Shorcham including a book, *Power Crazy* : *Is Lilco Turning Shoreham into America's Clicmobyl* by **Karl Grossman.** Another, and probably easier to obtain referrence for Indian readers is a scries of 3 articles in IEEE Spectrum (See Sources Below).

Sources : *The Shoreham Saga, IEEE Spectrum November* 1987.
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Heavy loss instead of heavy water

A welcome feature of the present government is that unlike it's predecessors it has allowed the office of the Comptroller and Auditor General of India (CAG) to audit atomic energy programmes and to publish findings. Here is what the ***CAG*** *has to say about the Tuticorin Heavy Water Plant.*

- The Tuticorin Heavy Water Plant (THWP) of the Department of Atomic Energy worked only at one-fifth (20.6 per cent) of the installed capacity during eight years after it was commissioned in 1978 resulting in a production loss of Rs. 123.97 crore.

At- the time of setting up of the plant, the cost of indigenous production of heavy water was estimated to be Rs. 500 per kg which compared favourably with the then landed cost of Rs. 670 per kg. It was now expected to go up to Rs. 13800 per kg 'on the basis of actual average annual production." The plant has operated only for 1284 days as against 2550 available days.

These startling revelations have been made in the latest report of the Comptroller and Auditor General of India on Scientific Departments presented in Parliament. The Tuticorin Heavy Water Plane was set up as part of the Indian Nuclear Power Programme aiming at an installed capacity of 10,000 Megawatt by 2000 A.D. through the establishment of a chain of natural uranium fuelled thermal reactors with pressurised heavy water used as moderator and coolant.

The report has observed that "scries of repairs, replacement and modifications at additional cost" coupled with "low production" has changed the "economic profile" of the plant. It says 'due note" has been taken of the view point that conventional methods of financial propriety and procedure should not be the yardstick in the case of scientific departments striving for self-reliance in hi-tech processes 'as a certain amount of hit and miss could happen in attempting to catch up with fast changing technology" and has left it for 'Parliament to judge how much of the scarce resources could be diverted to such ventures,"

Ironically, the plant is considered to be the "most successful" of operational heavy water plants in the country, having produced about 60 per cent of the indigenous heavy water the total requirement of which is estimated at 13,000 tonnes.

The plant was originally scheduled to be commusioned by January, 1975, after a technical collaboration agreement was entered into with a French consortium in April 1971. The plant, instead was commissined in July 1978, marking a delay of 42 months. However, the foreign collaborator—M/s Gelpra—was 'absolved of all their contractual obligations, guarantees, warranties etc., because "the. plant could not be run and tested on sustained basis due to power shut-down etc."

"In sum', the report remarks, "the imported technology had not. been successful but **the** foreign collaborator had been absolved of **all** contractual obligations." The technology transfer was incomplete at the time of **the** termination of the contract, the report says.

Citing technical reasons for the shortfall in production, the report notes that several modifications were carried out to overcome the identified problems. "This resulted in additional financial burden. The report observes: "In the light of the actual average annual production, the technology absorption and stabilisation of operational procedures seem doubtful."

The cost of production was first revised in 1979. It worked out to be Rs. 1145 per kg 'but many instalments of additional investment and shortfall in production have considerably escalated the cost of production. "The Department of Atomic Energy stated in September, 1987 that the cost of production at the achievable capacity worked out to be Rs. 4120 per kg but, according to the report, "this is only notional because the actual average production is much less than the achievable (derated) capacity taken tor the purposes of calculation by the department."

The report estimated the cost of production to be Rs. 13800 per kg. The factors which had contributed to high cost were, apart from low production levels, "increased capital deployment and increased consumption of utilities and spares". The maintenance cost was Rs. 1301 per kg, the consumption of power "was more than twice the limits indicated in the project report", the cost of utilities was Rs. 4000 per kg and the number of persons employed rose to 457 against only 35 persons who were to be given employment in accordance with the original agreement with the French consortium.

Courtsey : *Pushp Saraf Express News Service*
Indian Express : 29.4/88.

Ideological plurality is good for the movement

The recently concluded 'Save the Western Ghats' march has been a major milestone in the growth of the Indian environmental movement. For the first time, as many as 160 groups participated in the six-month long march.

More significantly, the march was not built around a single leader—indeed, the organisers worked hard to hold to the original idea of a movement composed of a decentralised and informal network of organisations.

This lack of ideological unity and charismatic leadership, deplored by some participants, can actually be viewed as a sign of the movement's muturity. The debates at the concluding session of the march were reported to be fierce: two of the more contentious issues being the utilisation of a religious idiom in spreading the message of environmentalism and the role of the government in ecological destruction and restoration.

The Western Ghats march provides an appropriate point of departure for an interim assessment of the problems and possibilities of the Indian environmental movement. We have corns a long way since the 1972 Stockholm conference, when the Third World dismissed - environmental protection at a Western fad. This growing consciouness is reflected at the popular level by the mushrooming of voluntary groups working in the field of environmental action and ecorestoration; and at an official level by the formal enactment of comprehensive legislation for controlling air and water pollution and protecting biological diversity.

During the last 15 years—that is, since the inception of the Chipko movement in 1073—the environmental movement in India has grown to such an extent that it may justifiably be viewed as perhaps the most effective in the Third world. While this spurt in environmental consciousness has been widely commented upon, what is less visible is the emergence of three distinct ideological perspectives within the movement.

The first strand, which we may call symbolic Gandhian, relies heavily on a religious idiom in its rejection of the modern way of life. It upholds the precolonial and pre-capitalist village community as the exemplar of ecological and social harmony. 'The methods of action favoured by this group are squarely in the Gandhian tradition—or at least of one tendency within it—fasts, *padayatras*, and *poojas* in which a traditional cultural idiom is invoked to further the strictly modern cause of environmentalism. The second, and perhaps most vigorous strand, can be termed a*ppropriate technology.*

Less strident in its opposition to industrial society, it strives for a working synthesis of agriculture and industry, big and small units, and Western and Eastern technological traditions. Both in its ambivalence about religion and in its unequivocal criticisms of hierarchy in modern and traditional society, it is markedly influenced by Western socialism. In its emphasis on constructive work, it also taps a somewhat different vein in the Gandhian tradition. This strand has done pioneering work in the creation and diffusion of appropriate technologies which use natural resources.

The third and most eclectic strand embraces a variety of groups who have arrived at environmentalism only after a protracted engagement with conventional political philosophies, notably Marxism. These include the so-called Peoples Science Movements—for example, the Kerala Sastra Sahitya Parishad—whose initial interest in "taking science to the masses" has widened to include environmental protection. The People Science Movements can be distinguished from the Gandhian elements in two major ways : in their unremitting hostility to tradition, and in the relatively greater emphasis on confrontational movements.

Interestingly, these disparate trends are reflected in the trajectory of India's most famous environmental initiative, Chipko. Whereas the group working with Sunderlal Bahuguna opposes industrial civilisation in its entirety, the group associated with Chandi Prasad Bhatt is closer to the appropriate technology strand. Finally, the wing of Chipko active in Kumaon is composed largely of Marxists who favour militant struggle.

Not withstanding these differences, one way in which all these strands within Indian environmentalism differ from the dominant thrust of the Western environmental movement is in their focus on equity and sustainability. Taking the industrial economy and consumer society for granted, Western environmentalists are far more concerned with "quality of life" issues such as the retention of biological diversity as a temporary haven from the workaday world, By contrast, environmental degradation in India is undermining the process of economic development itself-as the mismanagement of natural resources is both the cause and consequence of poverty and an inequitous social structure. The environmental movement has no choice but to emphasise the importance of nature as a resource for survival and subsistence as well as the imperatives of economic redistribution.

While symbolic Gandhians, appropriate technologists and ecological Marxists represent the three most forceful strands in the environment-development debate in the country, two additional points of view should be considered. One looks to protect the environment while excluding development from its horizons—this is the wildlife protection movement, votaries of which have tended to value certain animal species (for example, the tiger) higher than the less privileged members of their own species. Then we have the incurable optimists who view development in isolation from the environment, in the naive belief that there arc no physical limits to economic growth and that rapid industrialisation on the Western model can be brought about in a matter of decades.

The environment debate in India is as yet in its very early stages. The emergence of three clearly defined groups augurs well for the future development of the movement. While the moral critique of the symbolic Gandhians is combelling, their total rejection of modernity is problematic. As for the Marxists, while they arc especially strong in mobilising action, they are some what confused and disoriented in the long periods of social quiescence. Perhaps the most promising group at present are the appropriate technologists. Their perspective is most consistent with reality, whereas their political orientation is a balanced mix of activism and reconstruction.

However, both symbolic Gandhians and ecological Marxists play a critical role in widening the horizons of the movement. Too easily dismissed as ideological and political "extremists" respectively, they have helped greatly in sharpening the terms of the debate and in creating a public space for the activities of the appropriate technology strand.

In the interests of a continuing play of democratic forces-both within the movement and in society—this ideological plurality is to be welcomed.

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Courtsey : Times pf Mia : 31.5.1988.
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THE MALADY AND THE CURE

Today there is pervasive discontent all over the country. It results in inactivity and frustration and breeds irresponsibility all around. How do we channelise this discontent to create something positive is the prime question of today.

To expect the powers that be to redress people's grievances and bring about a fundamental transformation is to expect the impossible because today's office-bearers have a vested interest in this system. These problems have been created by the self-seeking politicians, plutocrats and beaurocrats.

This state of affairs is giving rise to different people's movements. There is the kisan movement, the antinuclear movement, the ecological movement like chipko and appiko, the womens movement for liberation, the anti-cow slaughter movement, the prohibition movement, movement for the decentralisation of power, the Jharkhand movement so on and so forth. All these movements have arisen and gained momentum outside the fold of political parties in these two decades thereby making parties irrelevant.

Even though some of these movements may appear to achieve their limited objective, as days pass by their very objective will be found to have receded further. It will be discerned that the state or the juggernaut of industrialization has created many more problems than the movement has solved.

Therefore unless all these unite on one platform and create a broad front for changing the whole anti-people system, not much headway seems to be possible for any one cause. The sooner this grim realization dawns on all concerned the better. This does not mean giving up movements for particular causes. Instead it means to pursue these more vigorously with a view to bring about a holistic conscientisation of the people, as well as to unite on the programme *to* change the politico-economic social system.

To attain this objective, we shall have to examine the methodologies of these movements affresh. Cessation of work, blockade of roads, bandhs, rallies, gheraos, jail bharo etc. are all right to generate confidence and boost the morale of participants by a massive show of strength. But these programmes have ceased to be novel anymore and have reached their saturation point,. Though these have not become counter productive. The establishment allows these to take place knowing full well that bandhs or rallies cannot last long. Persons participating in these militant actions will get exhausted. This will end in the status quo remaining unchanged. If any specific law is broken as part of jail bharo, government does not arrest satyagrahis or arrests them for a couple of hours and lets them off. This has become a routine affair, both with the satyagrahis and the authorities. How can millions of people march from their homes to the capital or district headquarters for rallies etc. every now and then, leaving their homes and workplaces

So a realisation is dawning as to why should we fight our battles on the field of the adversary Why not fight it out on our own field i.e. in villages and towns where we stay? Why not change methods and tactics? Why not opt out of the system as far as possible by boycotting it, by ignoring it and carrying on our work by creating a new system instead ?
For instance, if supplies of raw materials are stopped to towns and factories or if courts and police stations are not resorted to for the settlement of disputes and these arc settled by the old Panchayati system, can the present inequitous system be carried one Additionally, if goods manufactured in the centralised system like mill-cloth, soap or footwear are boycotted and instead village made cloth, soap and footwear are used, what will happen If ministers who represent this system are not invited for inauguration or for presiding over social functions and if their public meetings are boycotted how long can they hold out against this political, economic

and social non-cooperation movement ? Along with this negative aspect, in the very course of fighting out this system, we are creating a new system based on self-reliance, mutual sharing, decentralisation etc. If voters, instead of lying scattered, come together to constitute voter's councils and set up peoples' candidates based on certain criteria at election-times are we not utilising the ballot box-fruitfully to create a political apparatus responsive to people's aspirations, thereby making democracy participatory and meaningful?

All these ideas need widespread experimentation. More and more innovations on these lines is the need of the day. All these must become an integral part of the new life movements. This and such other kindred matters need serious consideration and community action so as to bring about a fundamental systemic transformation that is total revolution.

Thakurdas Bang
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